FIG. 1

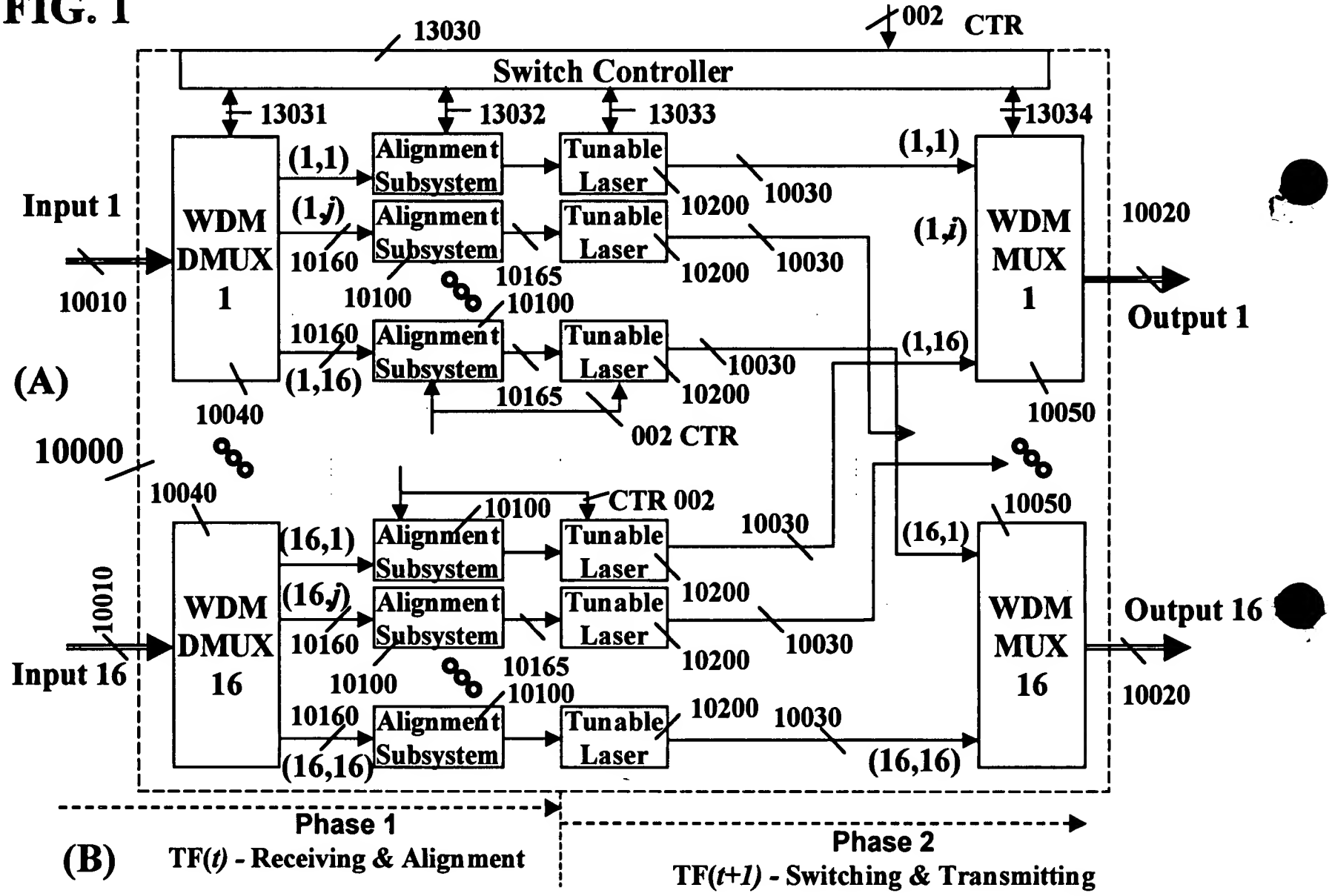


FIG. 2

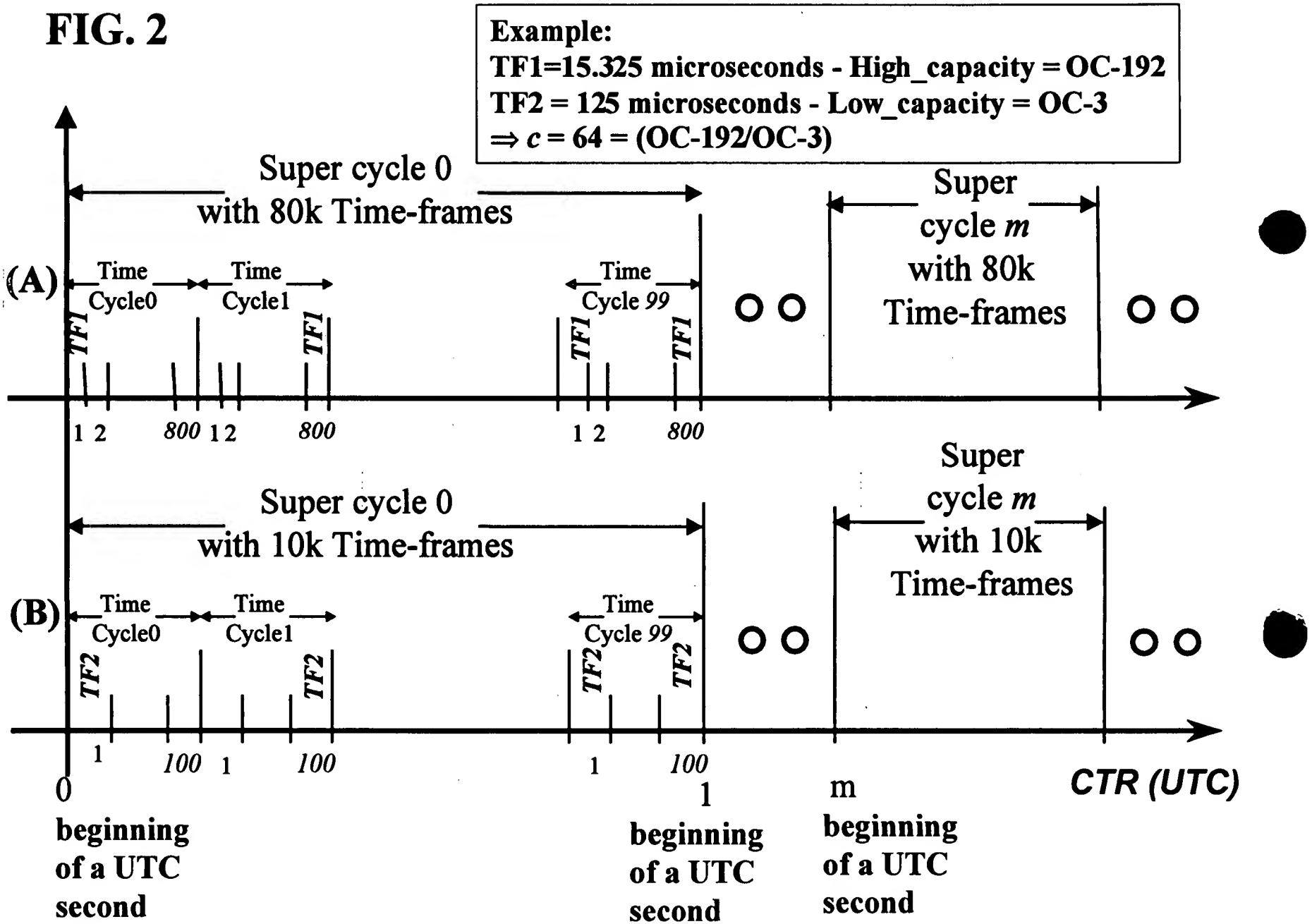

Example:
TF1=15.325 microseconds - High_capacity = OC-192
TF2 = 125 microseconds - Low_capacity = OC-3
⇒ c = 64 = (OC-192/OC-3)
Super cycle 0
with 80k Time-frames
Super
cycle m
with 80k
Time-frames
(A)
Time
Cycle0
Time
Cycle1
Time
Cycle 99
TF1
1 2
800
Super cycle 0
with 10k Time-frames
Super
cycle m
with 10k
Time-frames
(B)
TF2
1
100
0
beginning
of a UTC
second
1
beginning
of a UTC
second
m
beginning
of a UTC
second
CTR (UTC)

FIG. 3

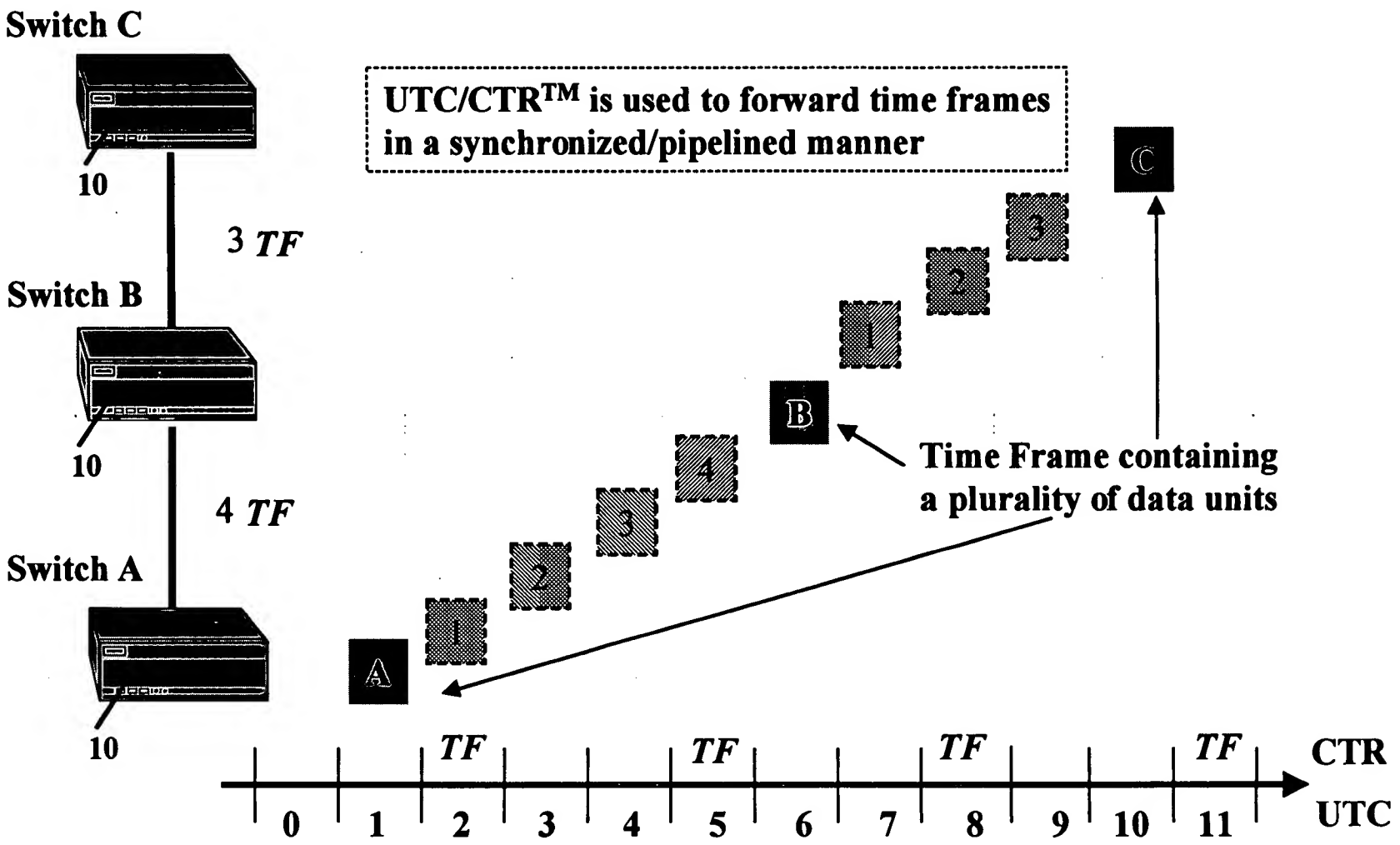
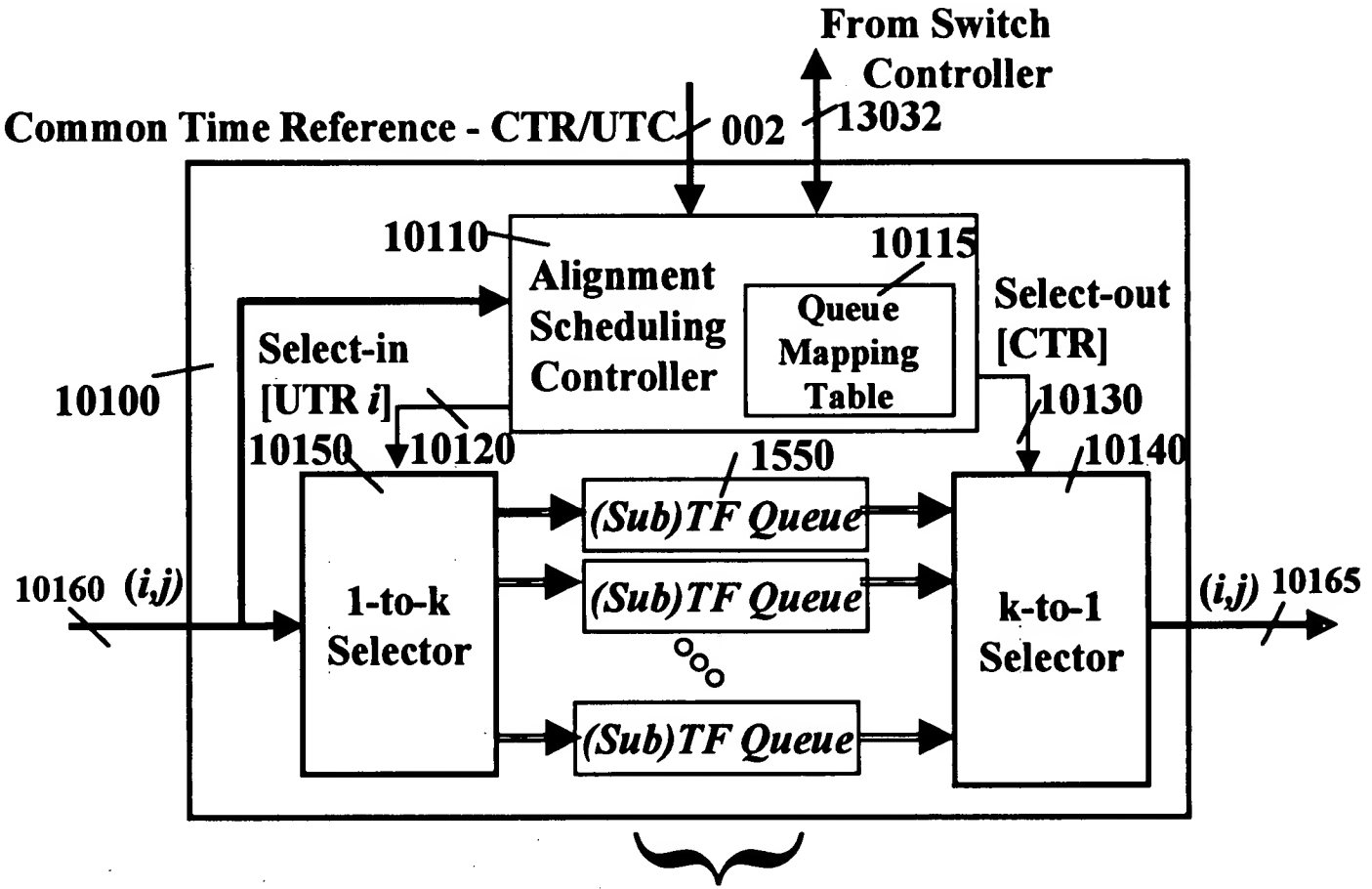


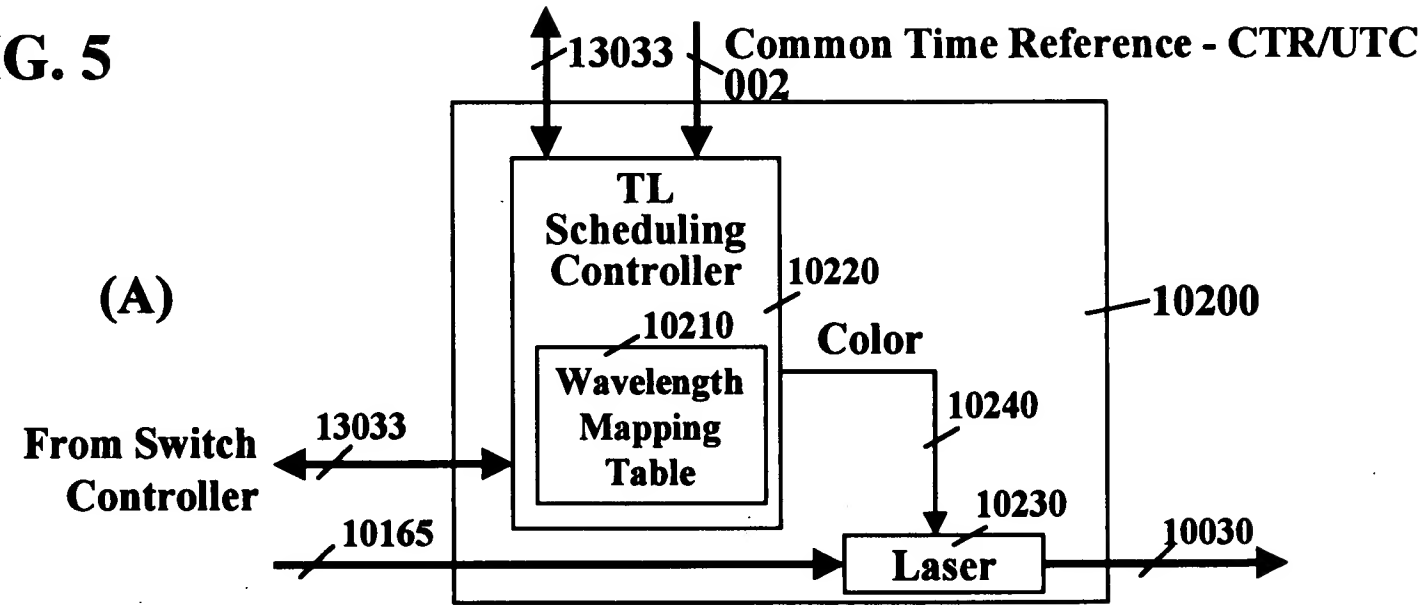
FIG. 4

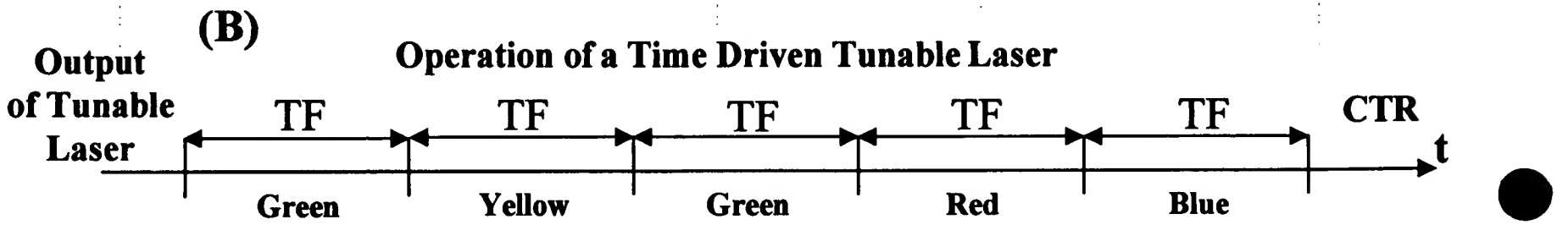


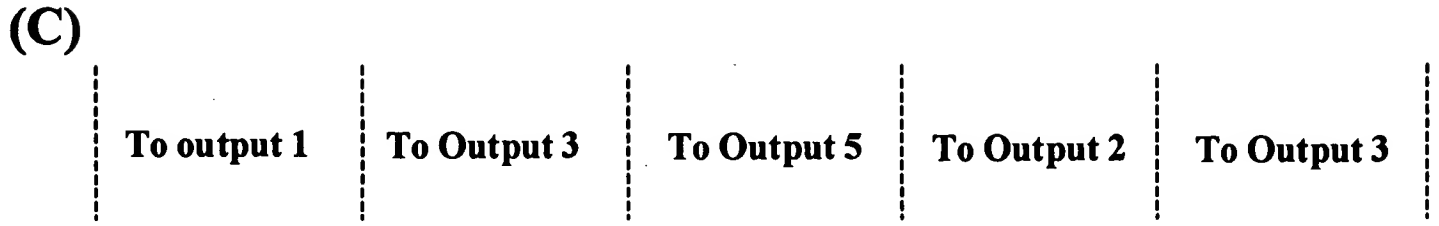
Alignment Subsystem for *high capacity* Channel *j* at Input Interface *i* with a Plurality of Sub-Time Frame Queues

TF*i_j*: Time frame duration on channel *j* at Input Interface *i*.
UTR*i*: UTR on link connected to Input Interface *i*

FIG. 5







Implication on a Wavelength Division De-multiplexer of a downstream switching system

FIG. 6

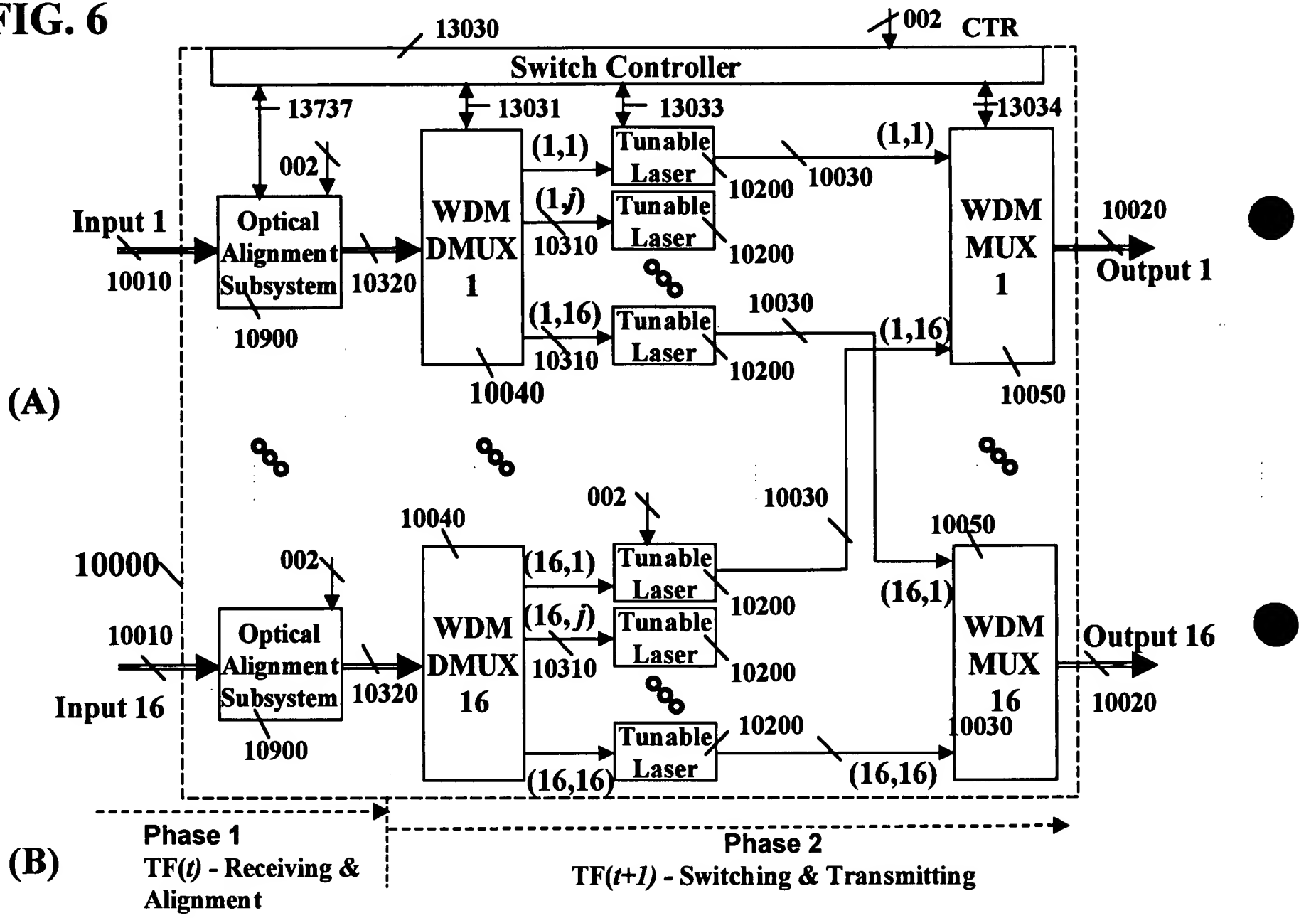


FIG. 7

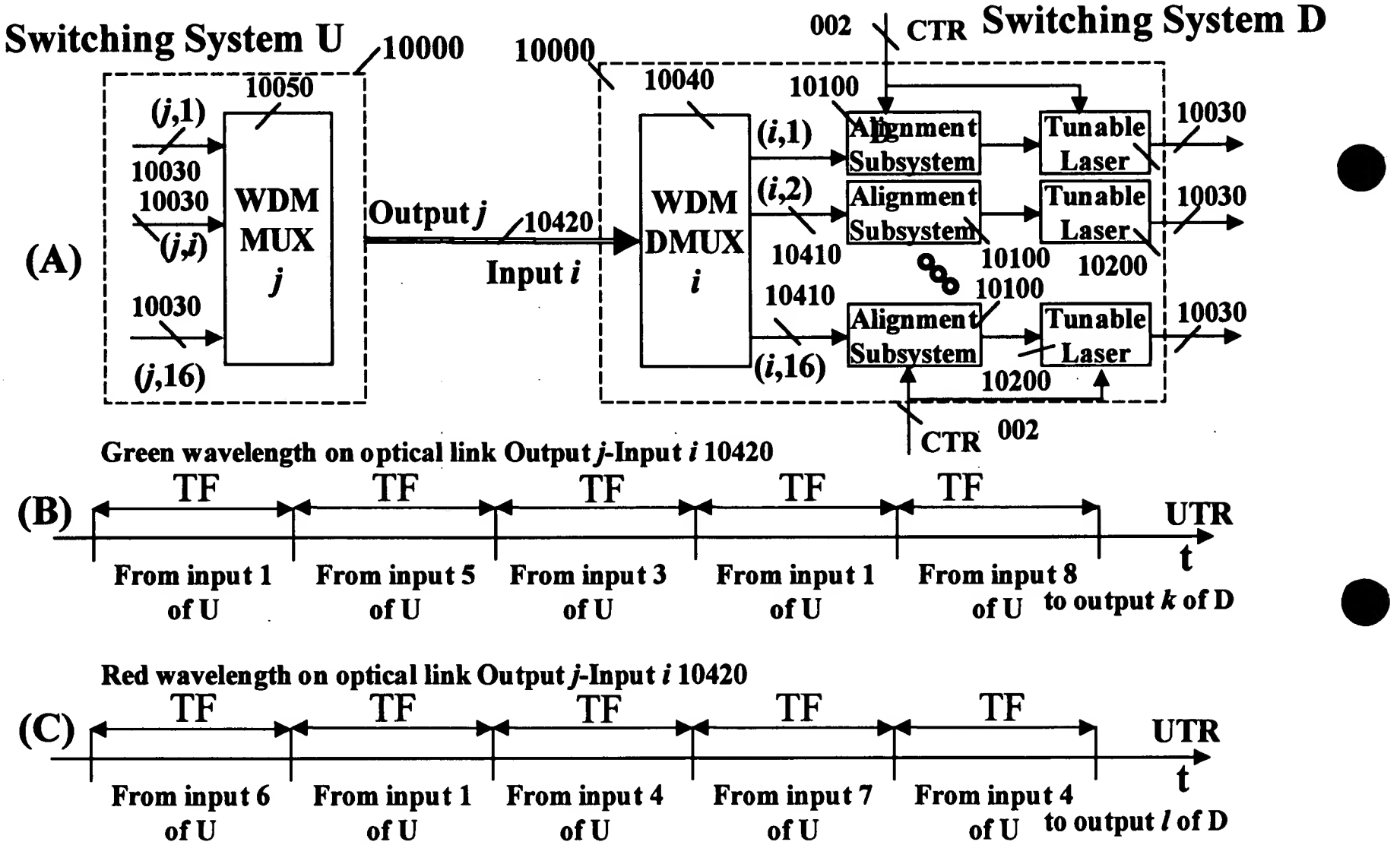


FIG. 8

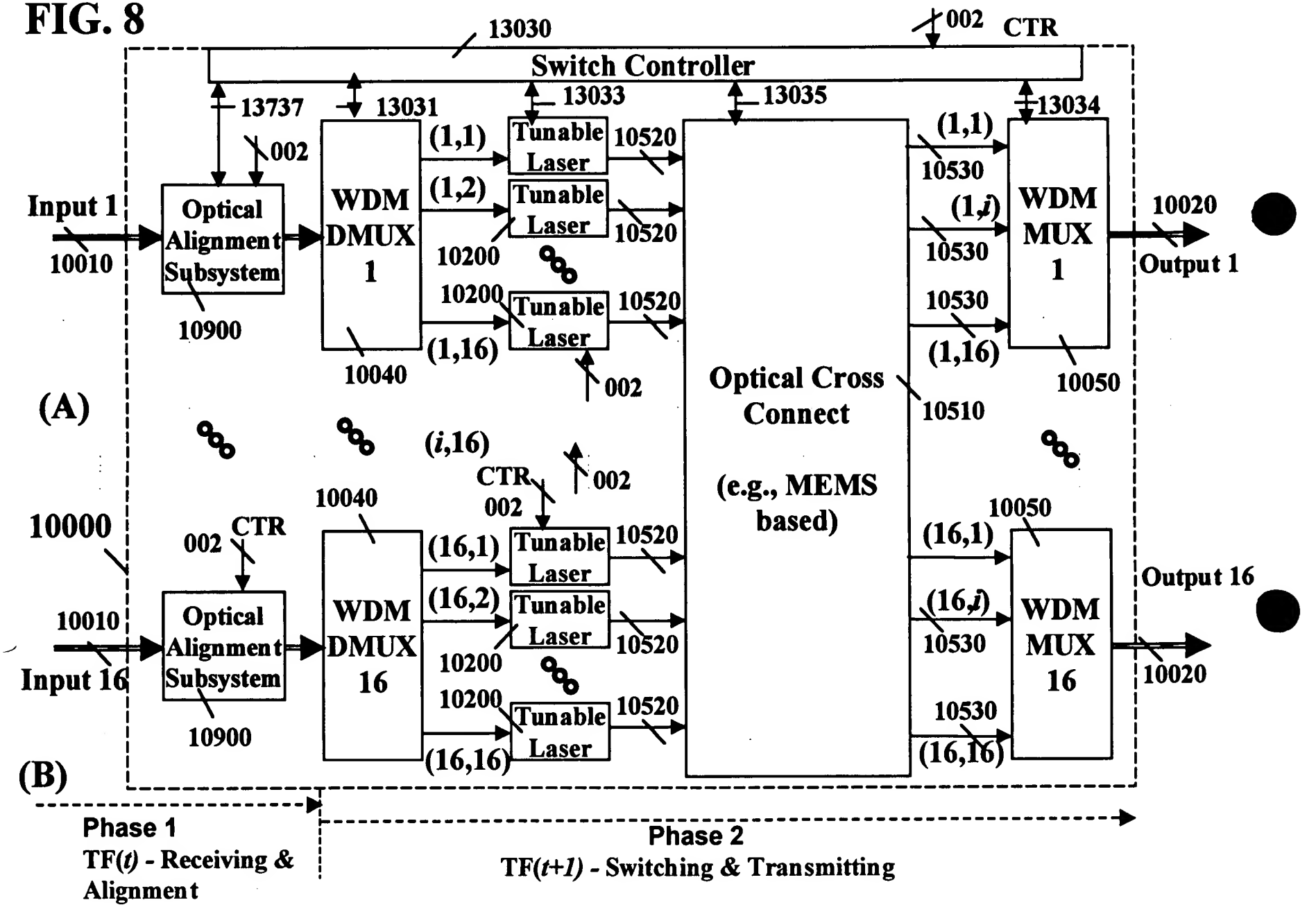


FIG. 9

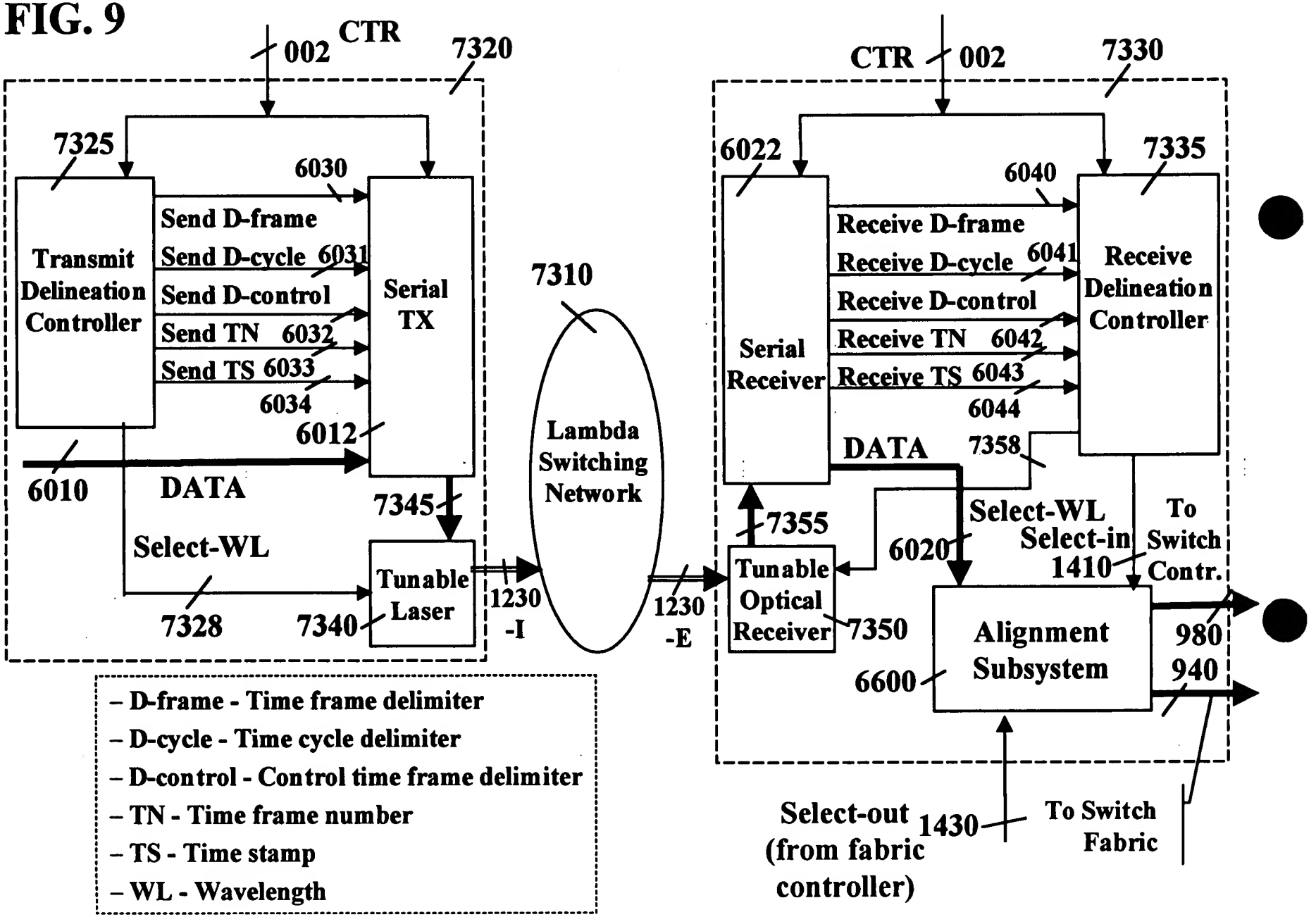

002
CTR
7320
7325
6030
Transmit Delineation Controller
Send D-frame
Send D-cycle 6031
Send D-control
Send TN 6032
Send TS 6033
6034
Serial TX
6012
6010
DATA
7345
Select-WL
7328
Tunable Laser
7340
1230 -I
7310
Lambda Switching Network
1230 -E
CTR
002
7330
6022
Serial Receiver
7335
6040
Receive D-frame
Receive D-cycle 6041
Receive D-control
Receive TN 6042
Receive TS 6043
6044
Receive Delineation Controller
DATA
7358
7355
Select-WL
6020
Select-in 1410
To Switch Contr.
Tunable Optical Receiver
7350
Alignment Subsystem
6600
980
940
Select-out (from fabric controller)
1430
To Switch Fabric
– D-frame - Time frame delimiter
– D-cycle - Time cycle delimiter
– D-control - Control time frame delimiter
– TN - Time frame number
– TS - Time stamp
– WL - Wavelength

FIG. 10

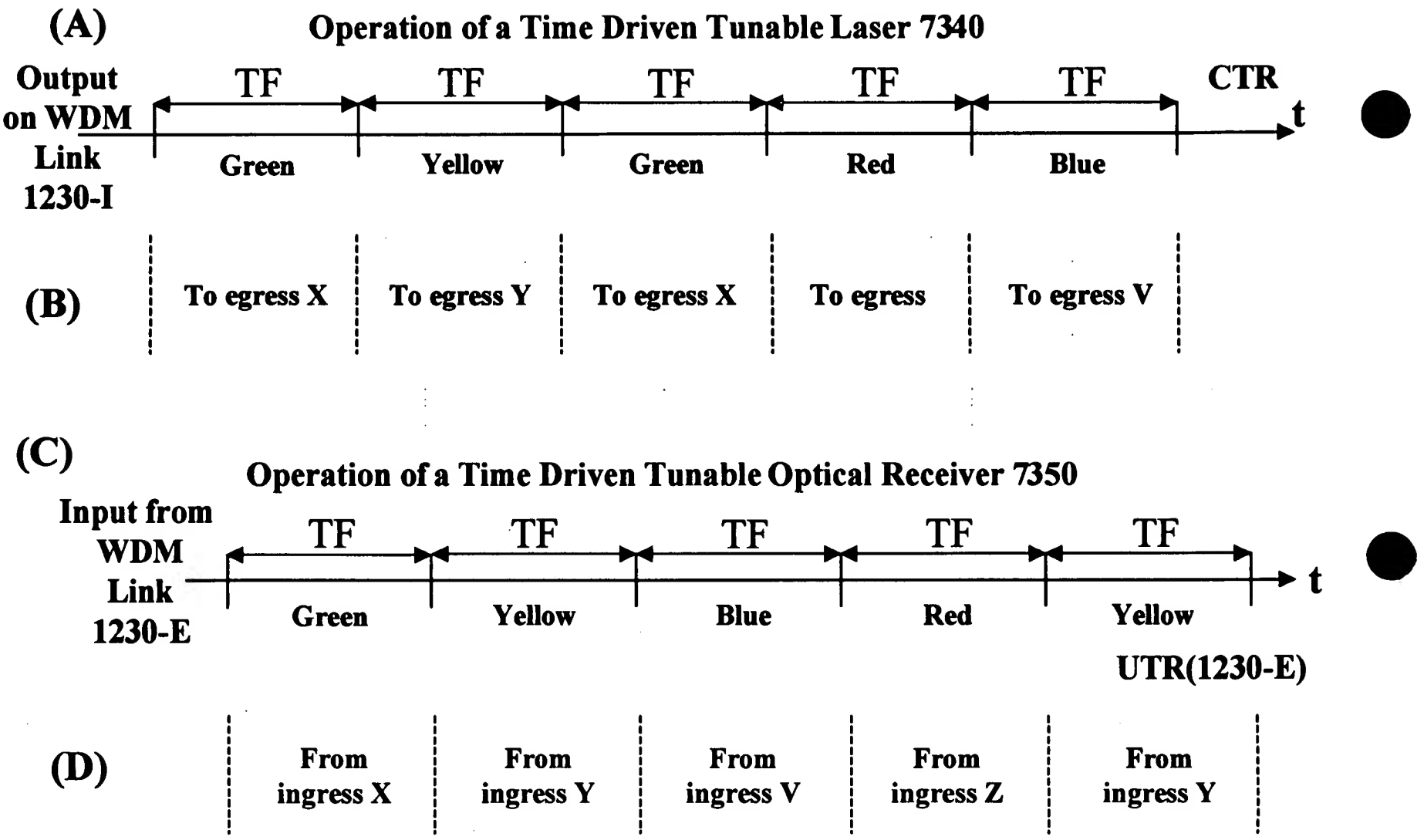


FIG. 11

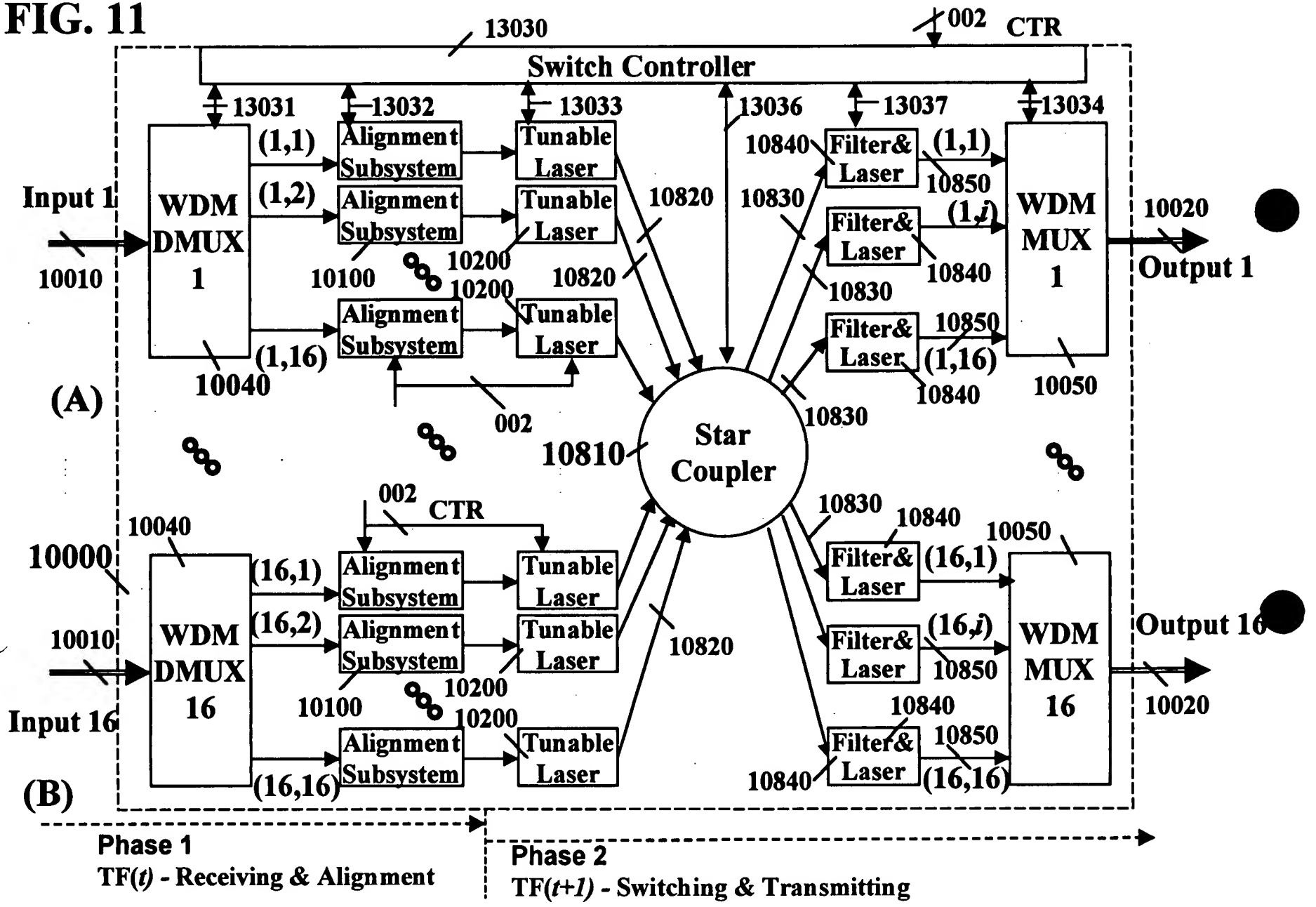
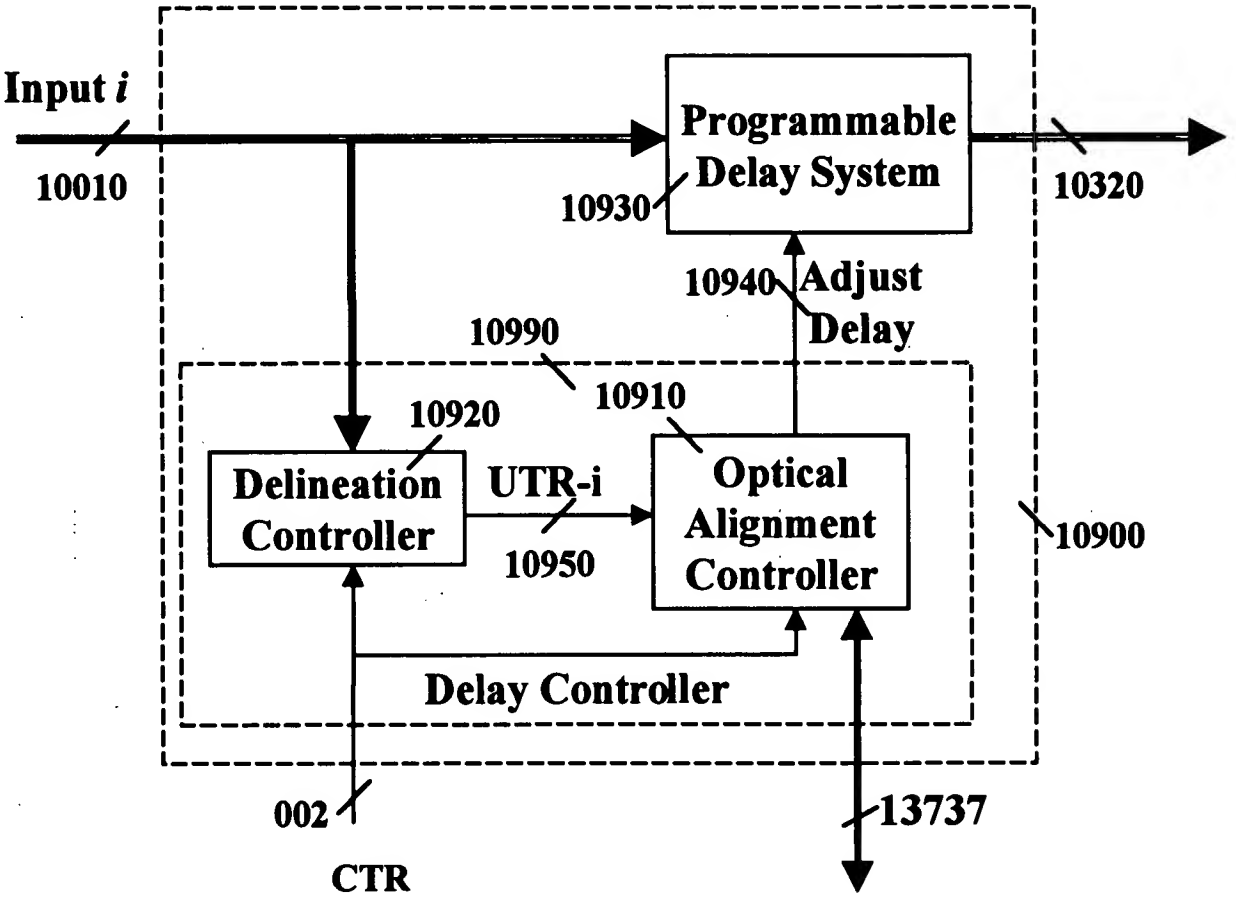


FIG. 12



UTR-i: Unique Time Reference of input link *i*
CTR: Common Time Reference

FIG. 13

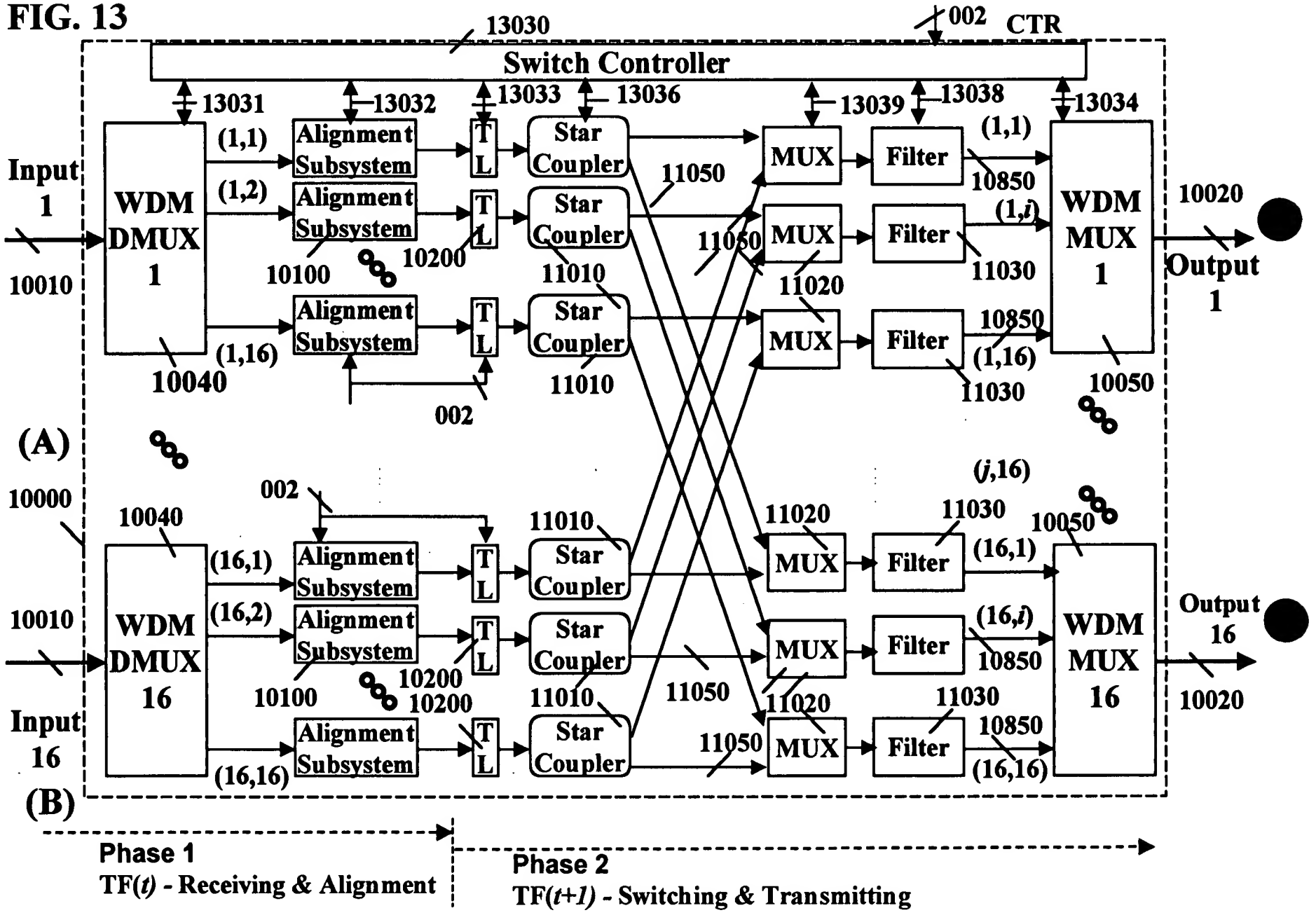


FIG. 14

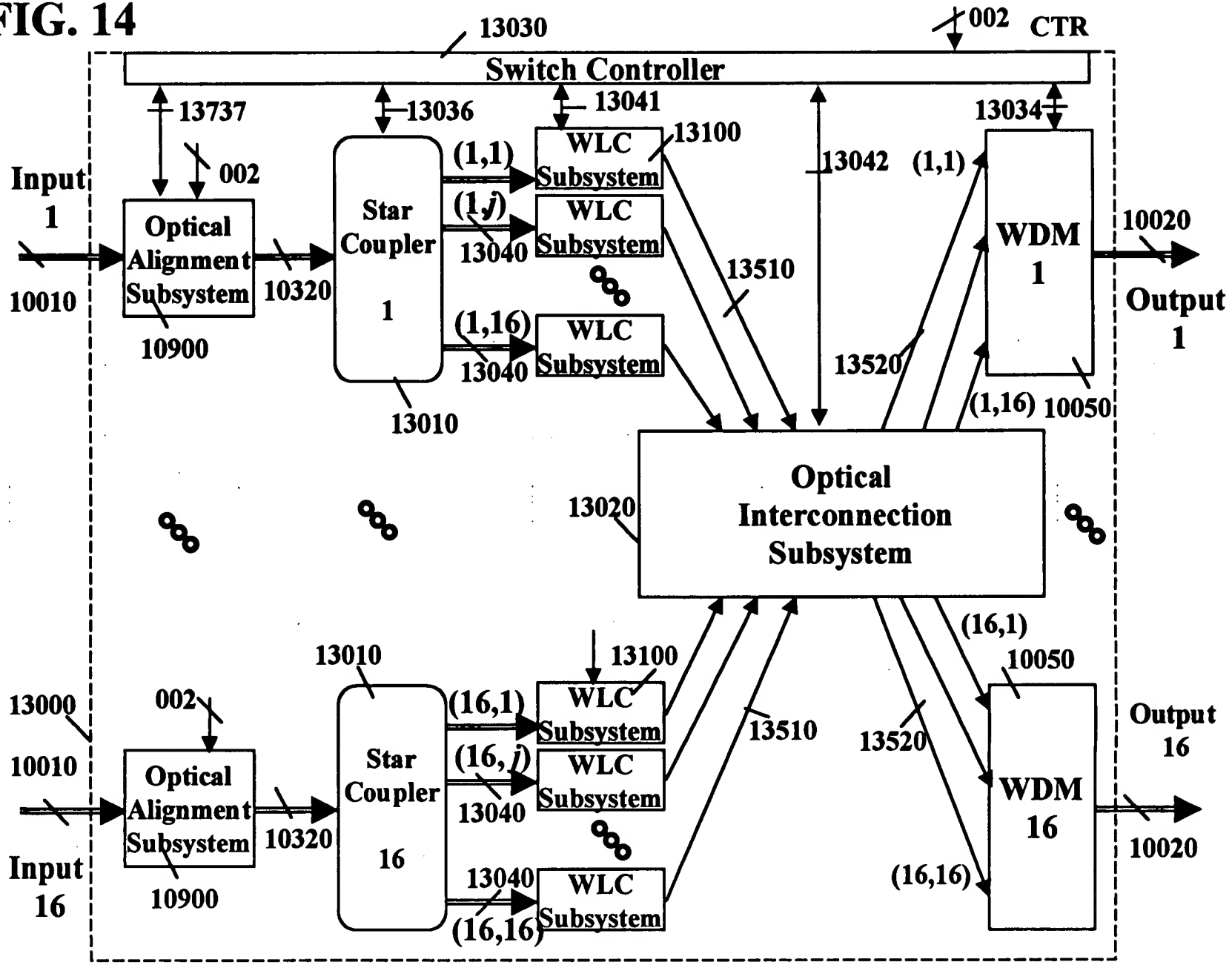
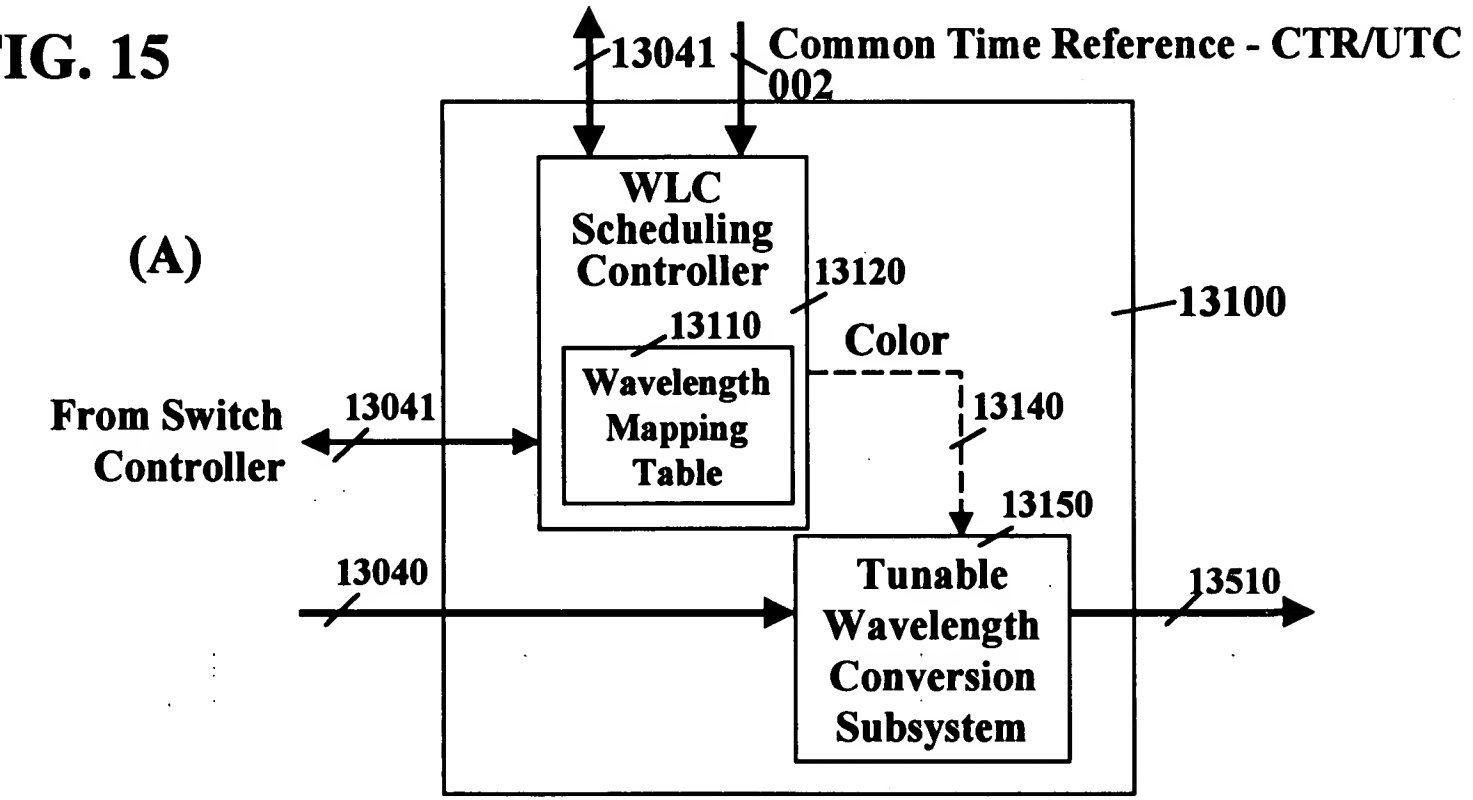
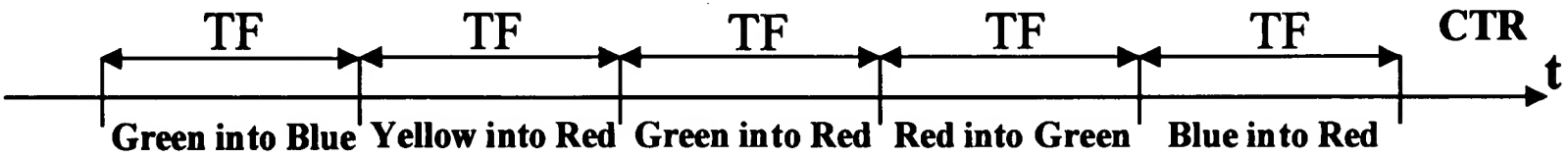


FIG. 15



(B)

Operation of a Time Driven Tunable Wavelength Conversion Subsystem 13150



Wavelengths received 13040 and emitted 13510 by Tunable Wavelength Conversion Subsystem 13150

FIG. 16

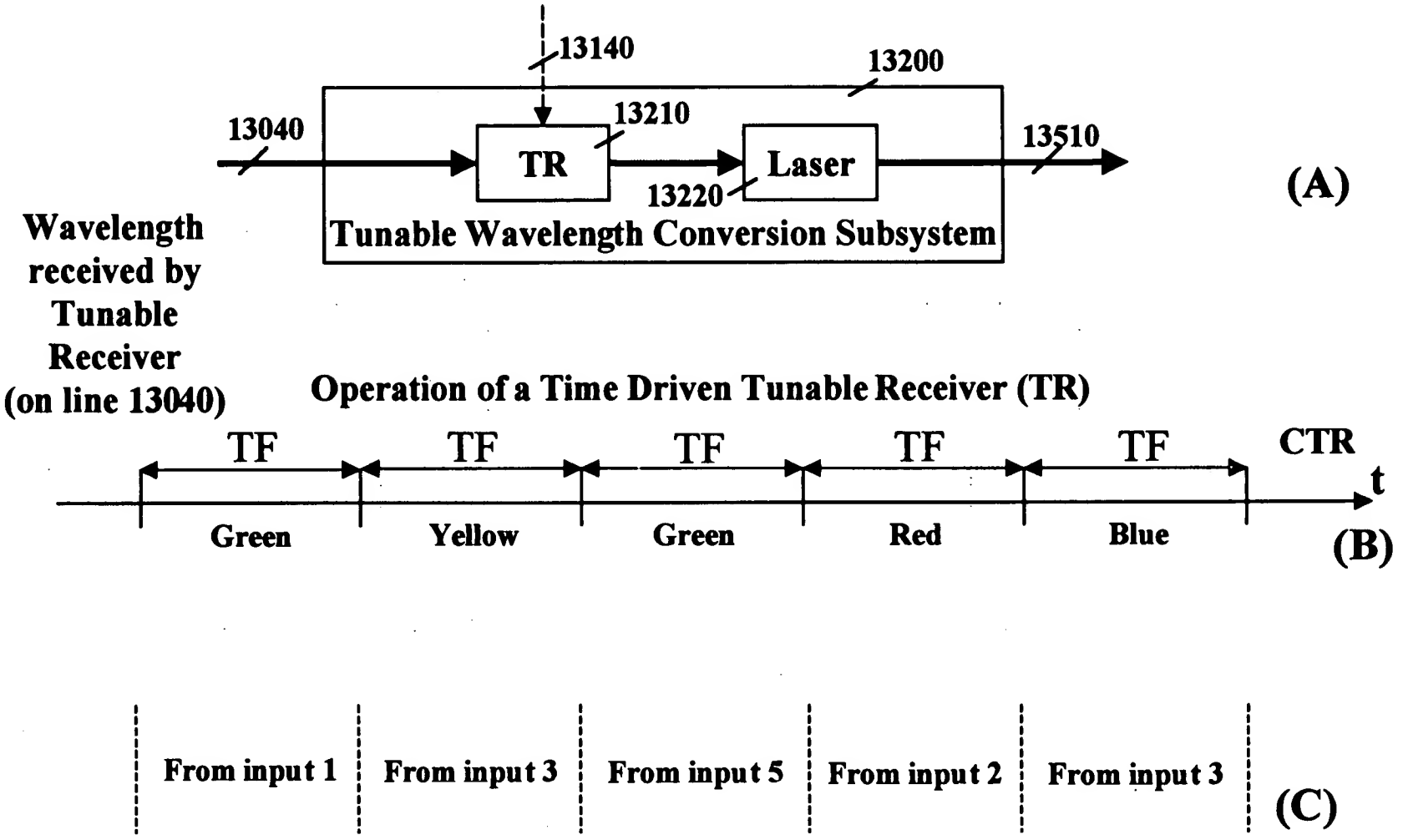


FIG. 17

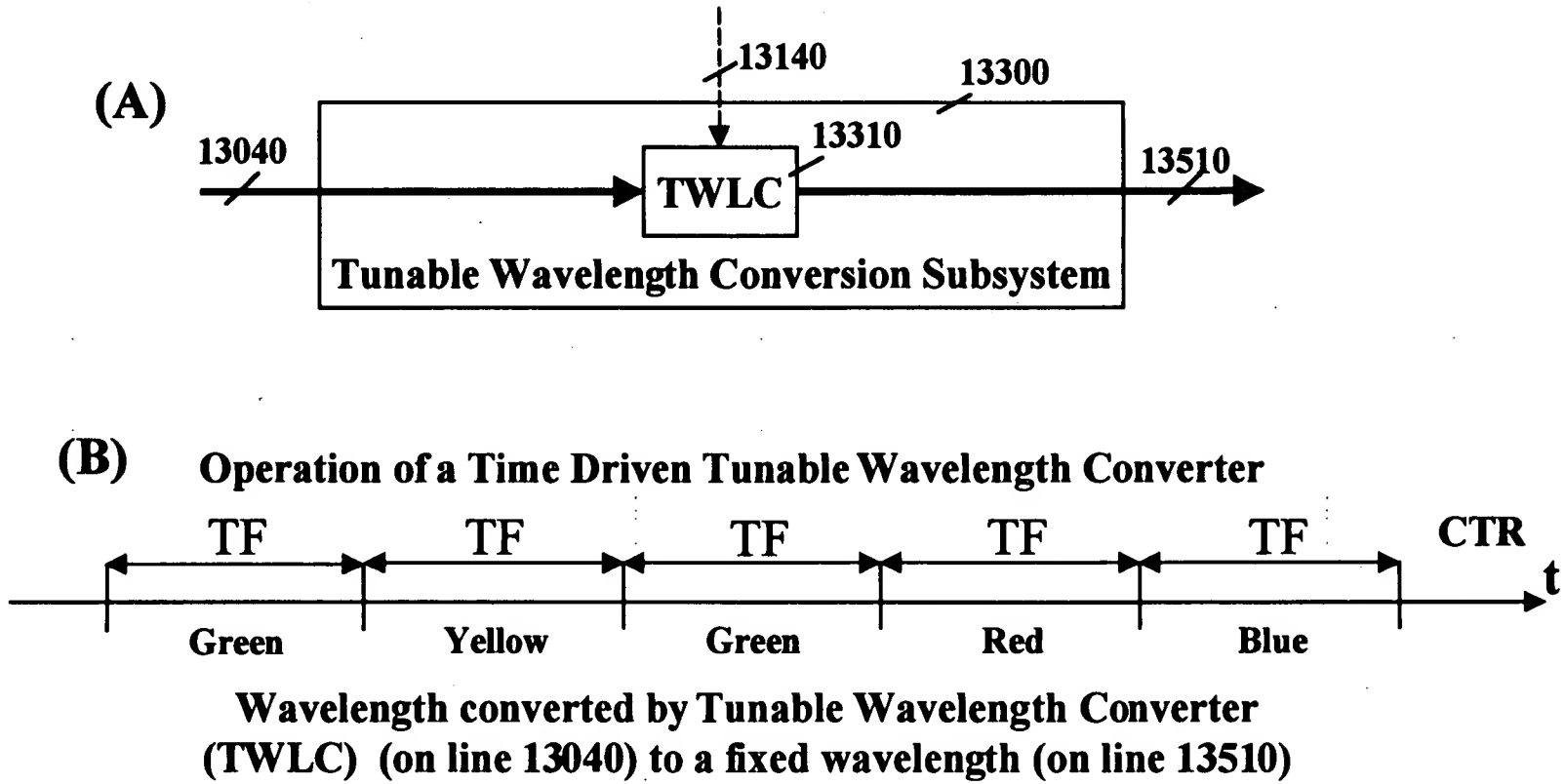
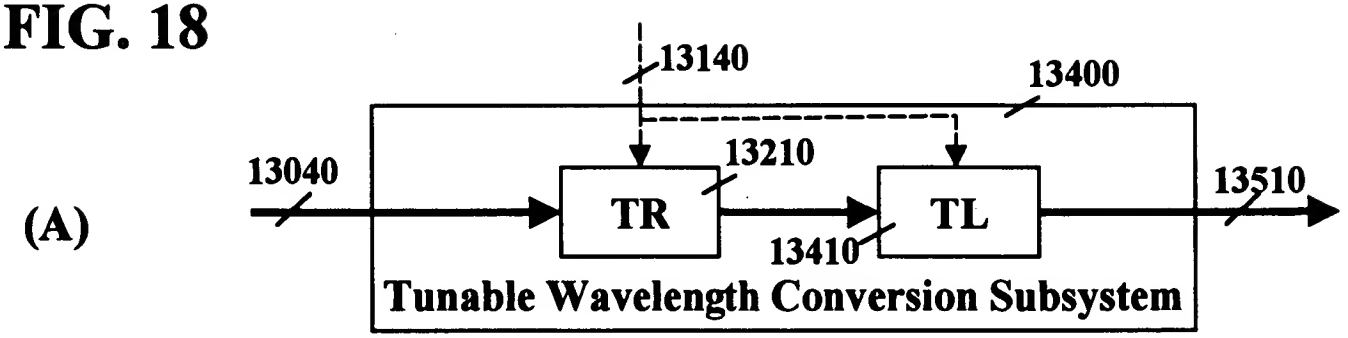
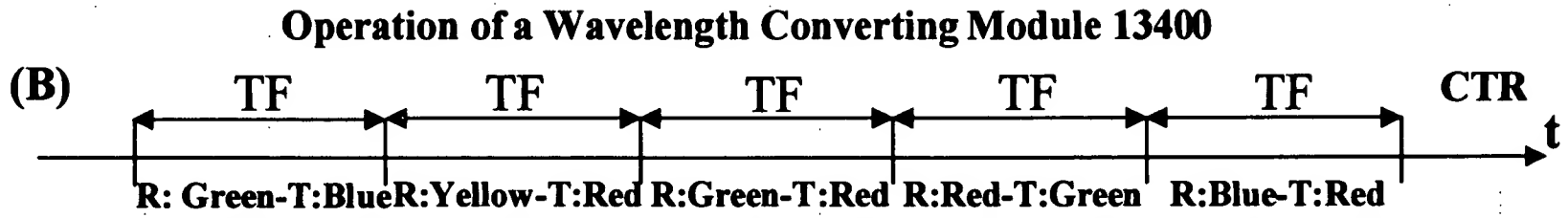


FIG. 18





Wavelengths received 13040 and generated 13510 by Tunable Wavelength Conversion Subsystem 13400

R= received T=transmitted

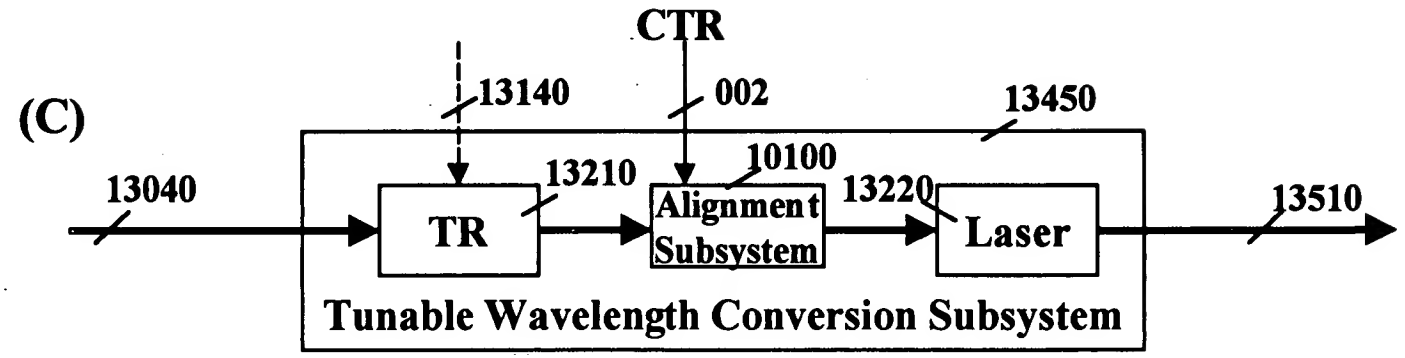


FIG. 19

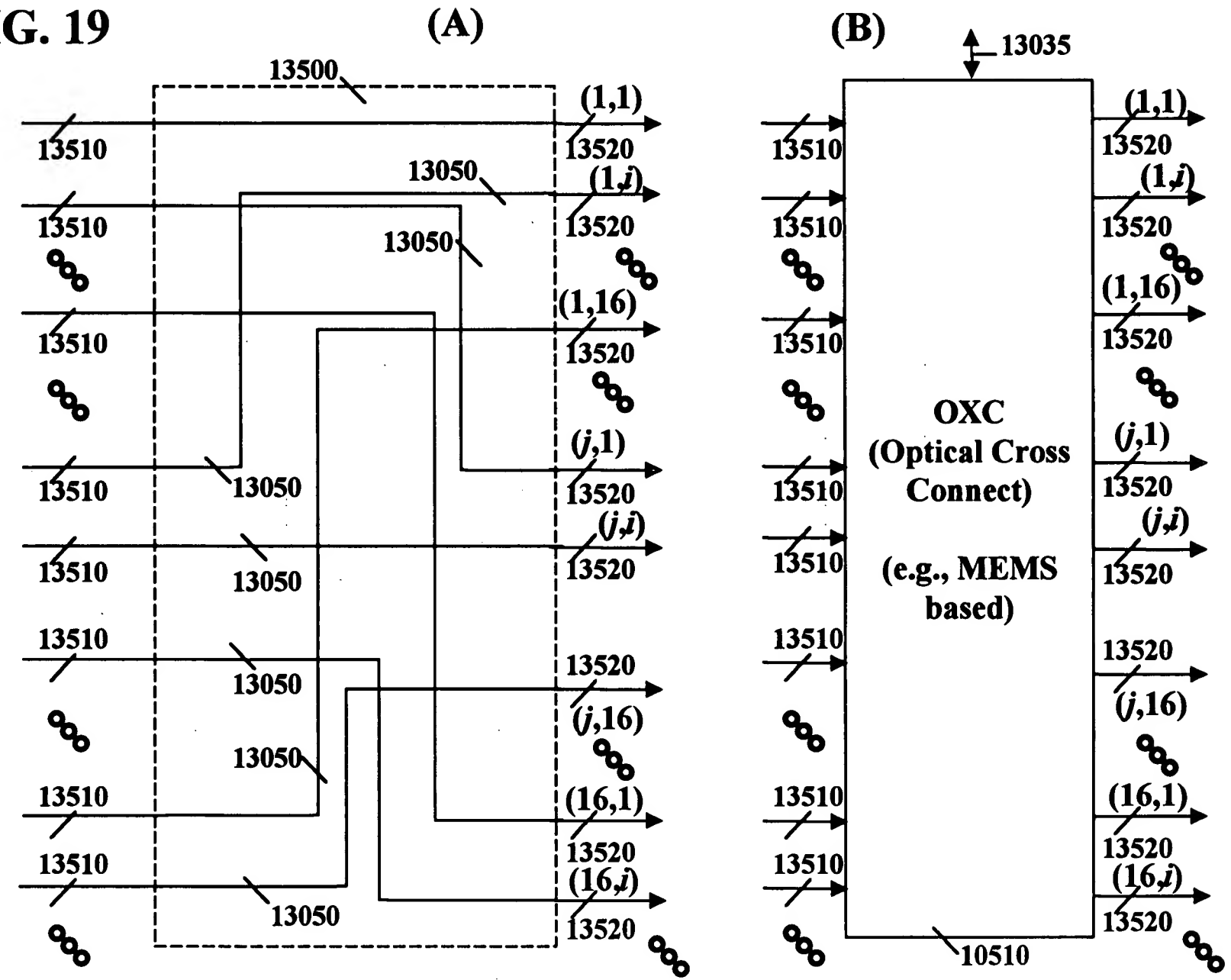


FIG. 20

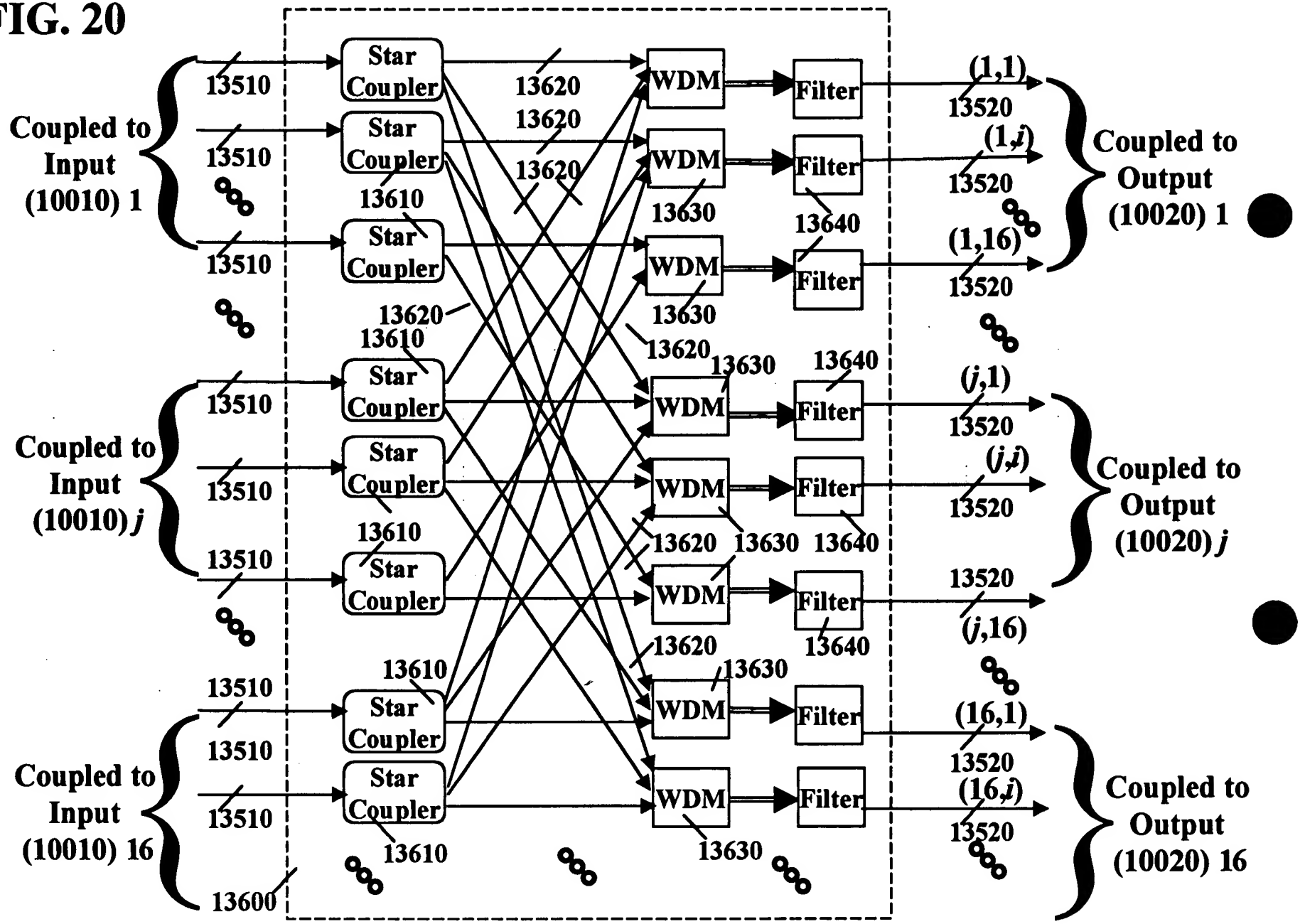

Coupled to Input (10010) 1
Coupled to Input (10010) j
Coupled to Input (10010) 16
13510
13600
Star Coupler
13610
13620
WDM
13630
Filter
13640
(1,1)
(1,i)
(1,16)
(j,1)
(j,i)
(j,16)
(16,1)
(16,i)
13520
Coupled to Output (10020) 1
Coupled to Output (10020) j
Coupled to Output (10020) 16

FIG. 21

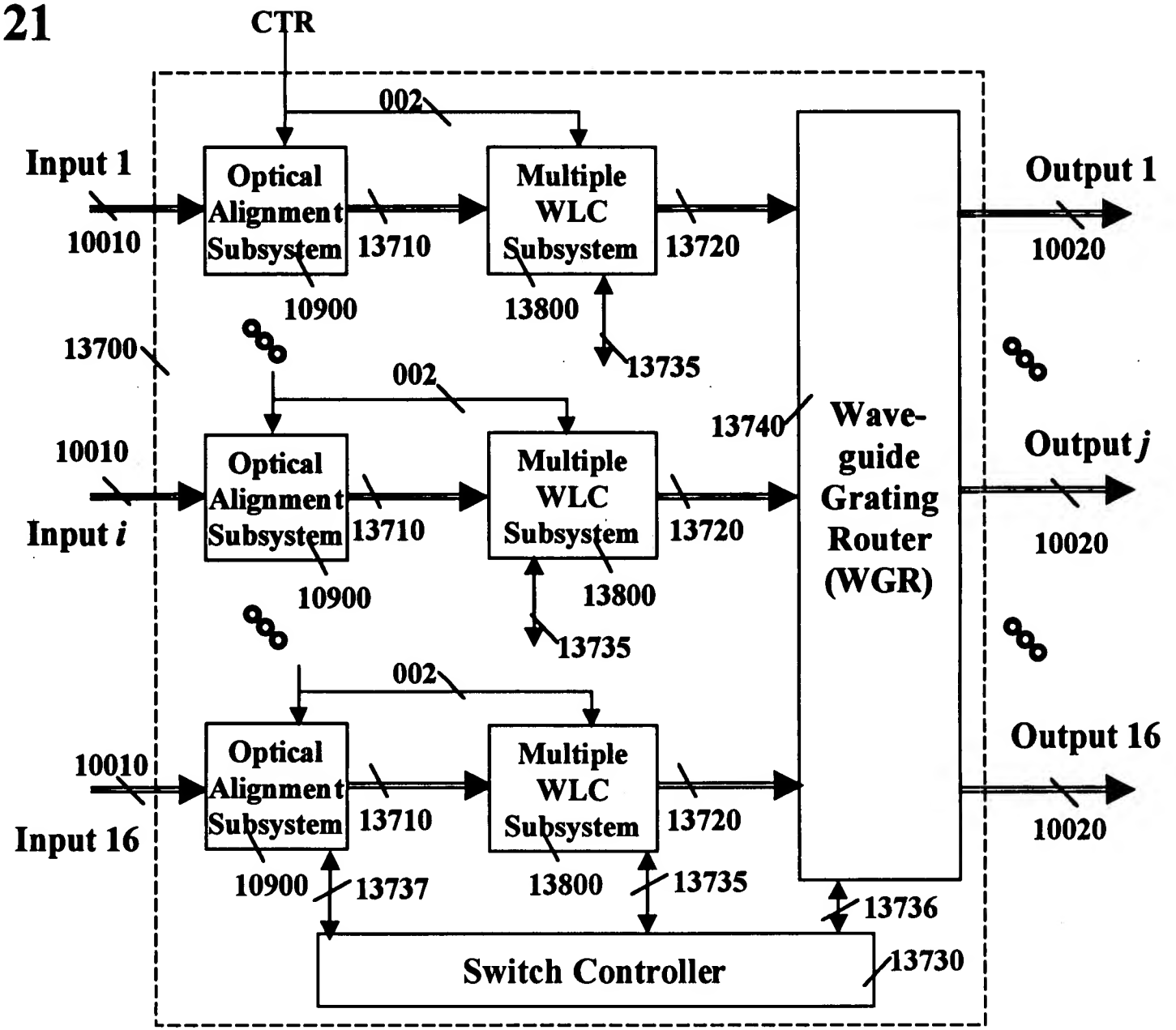


FIG. 22

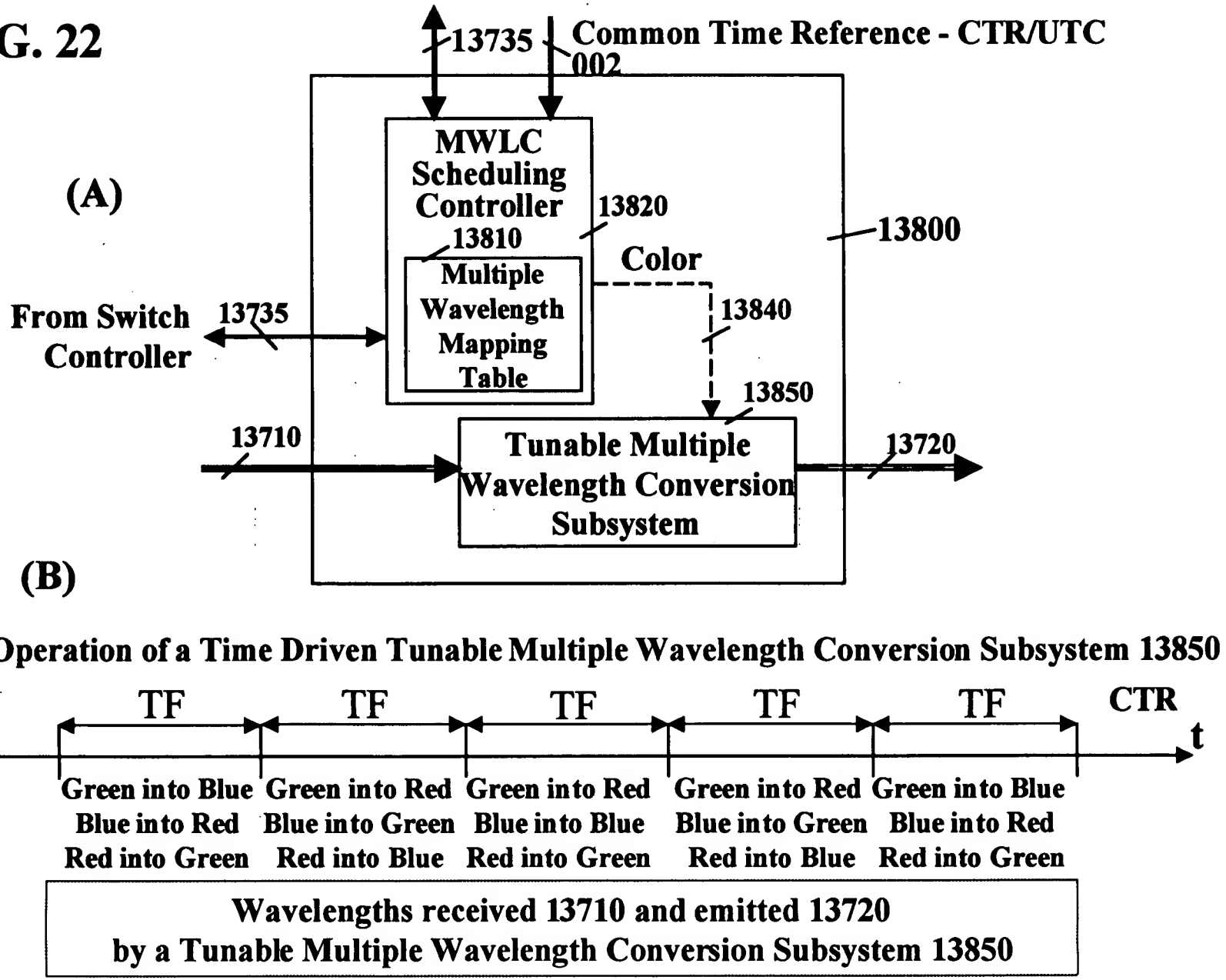


FIG. 23

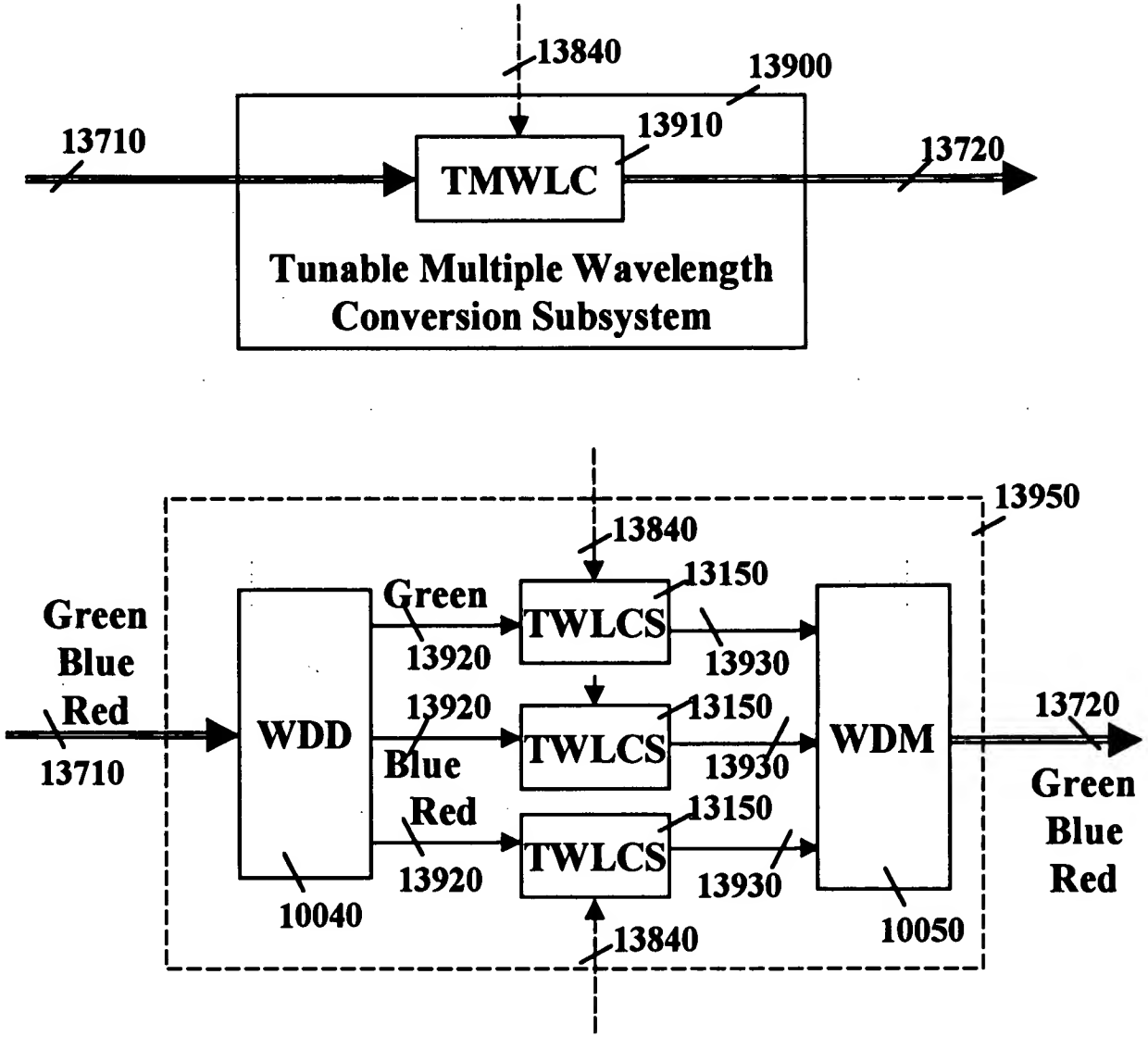


FIG. 24

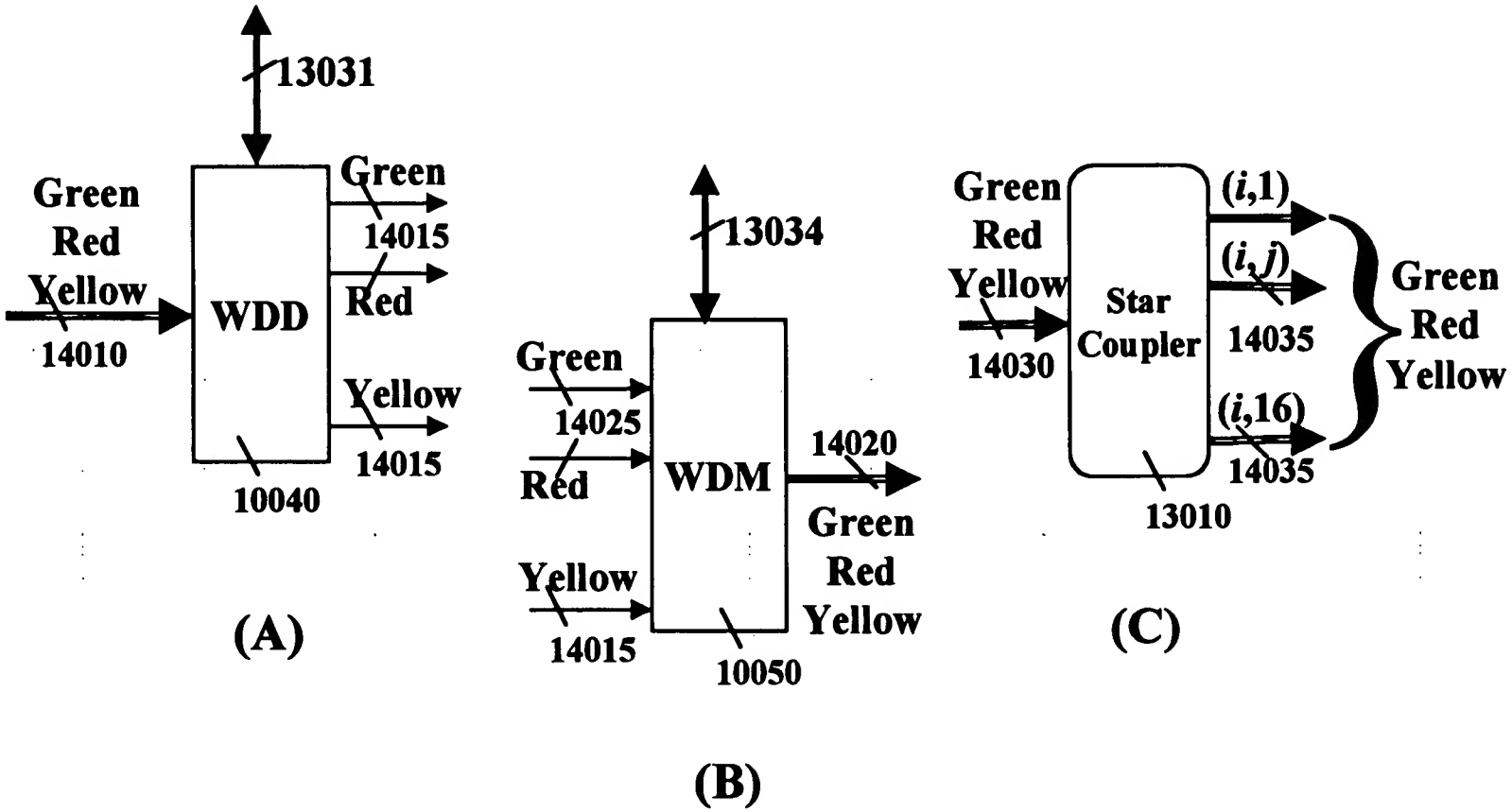
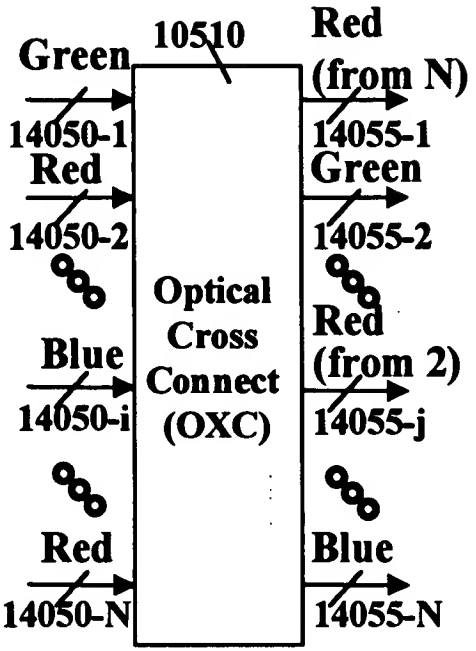
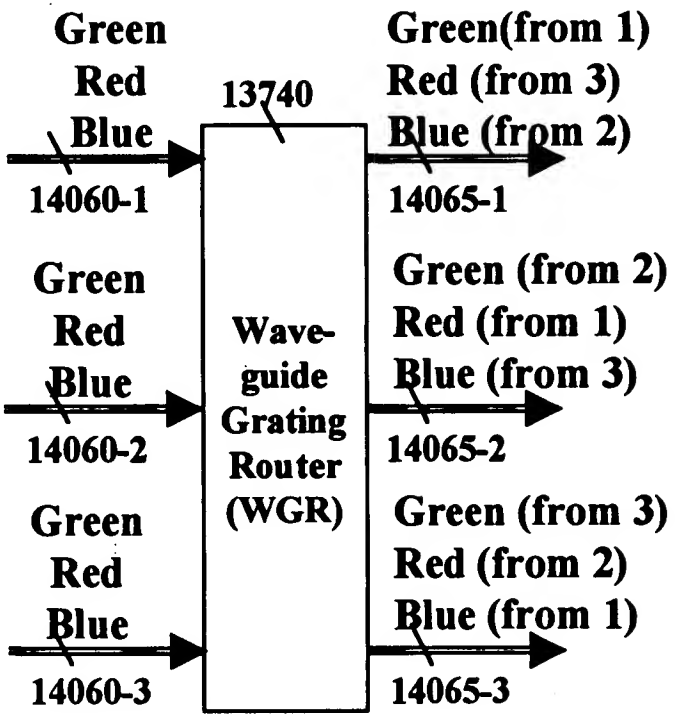


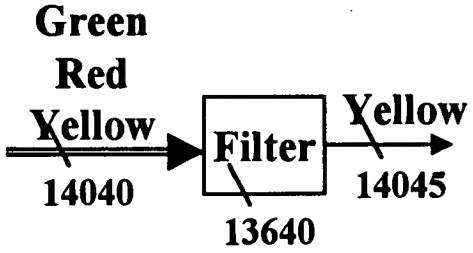
FIG. 25



(A)



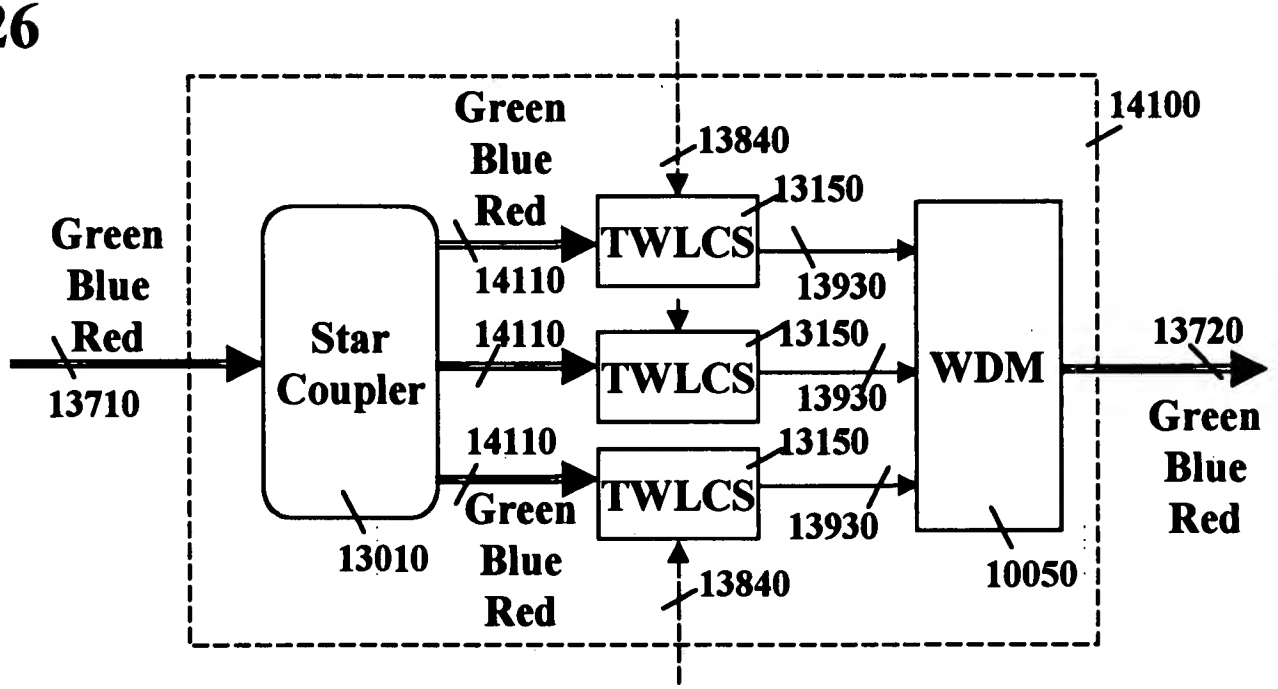
(B)



(C)

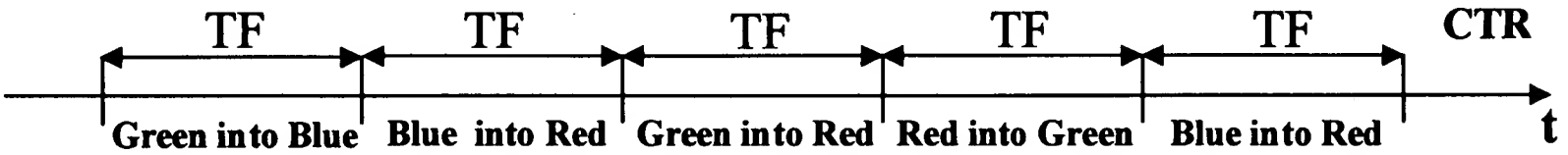
FIG. 26

(A)



(B)

Operation of a Tunable Wavelength Conversion Subsystem (TWLCS) 13150



Wavelengths received (on line 14110) and emitted (on line 13930) by a Tunable Wavelength Conversion Subsystem 13150

FIG. 27

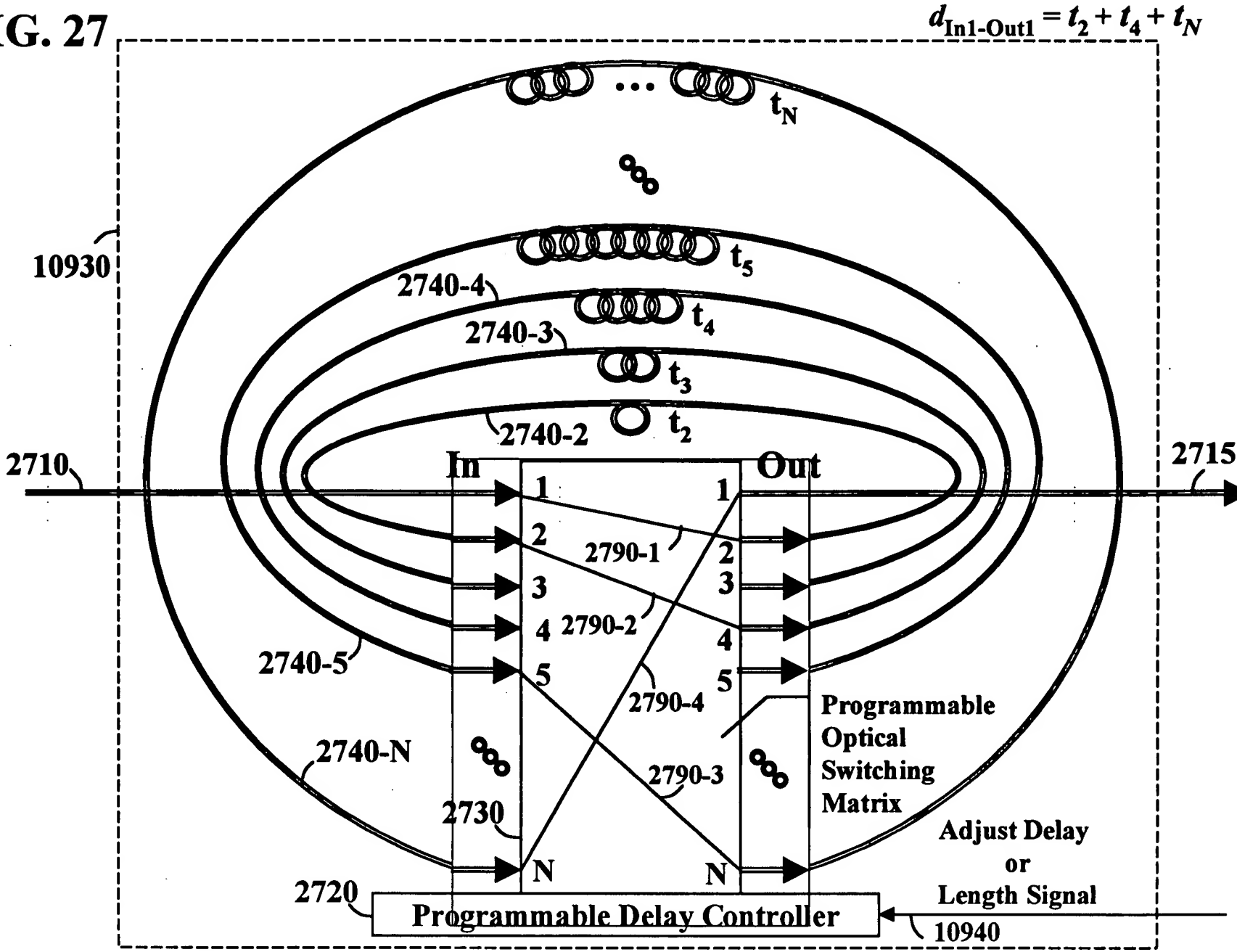


FIG. 28

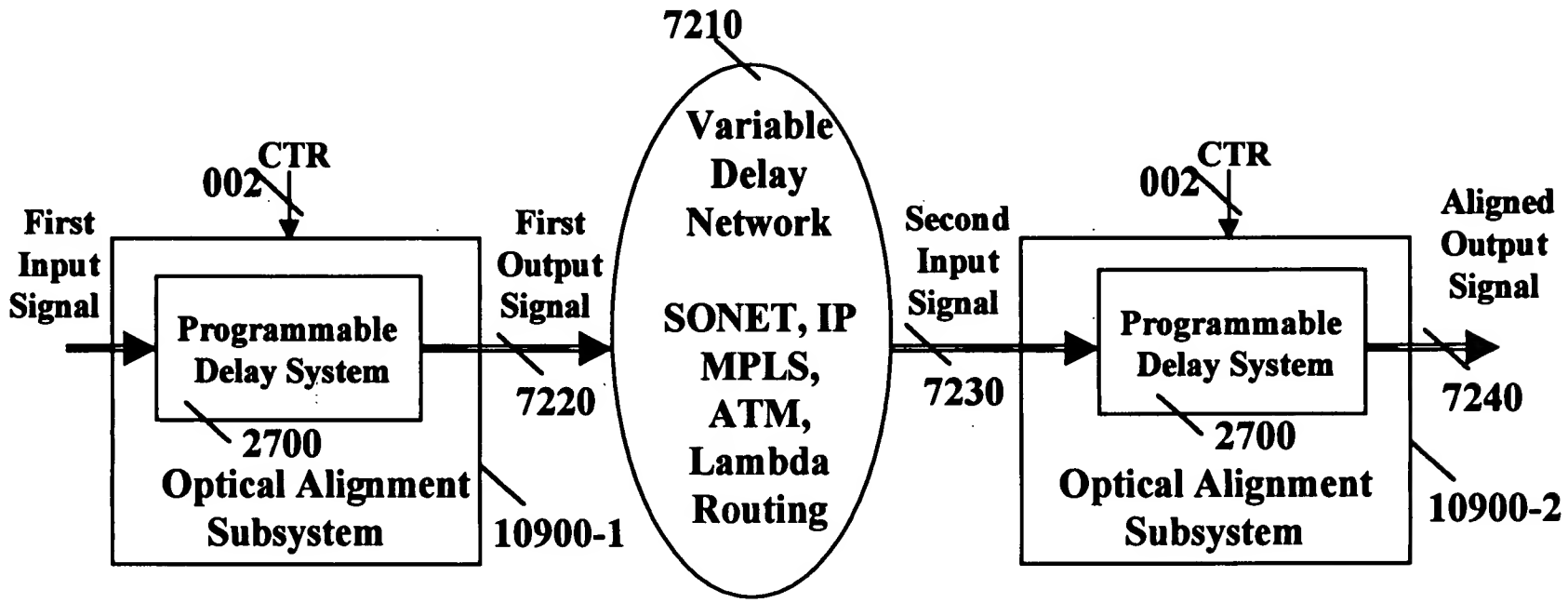


FIG. 29

***TF Alignment of* UTR(*i*) *to* UTC -** **with three input queues - principle of operation:**

The same queue is not used simultaneously for:

1. **Receiving data packets from the serial link, and**
2. **Forwarding data packets to the switch**

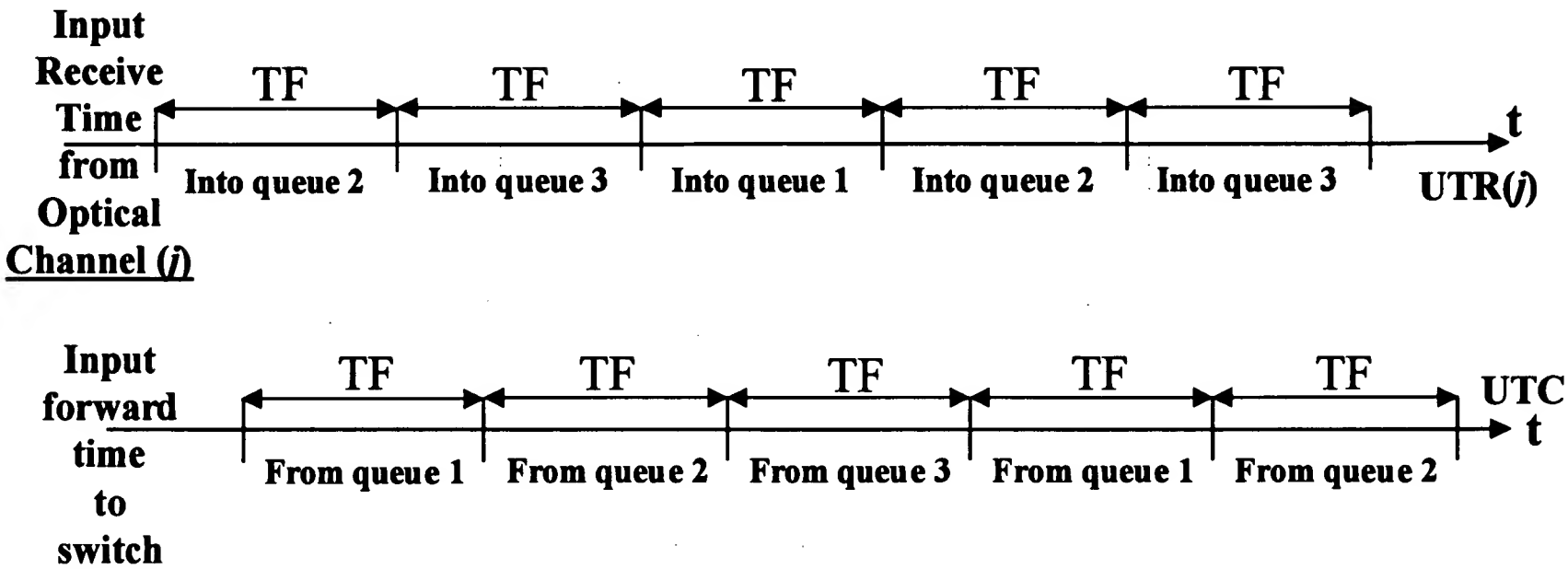
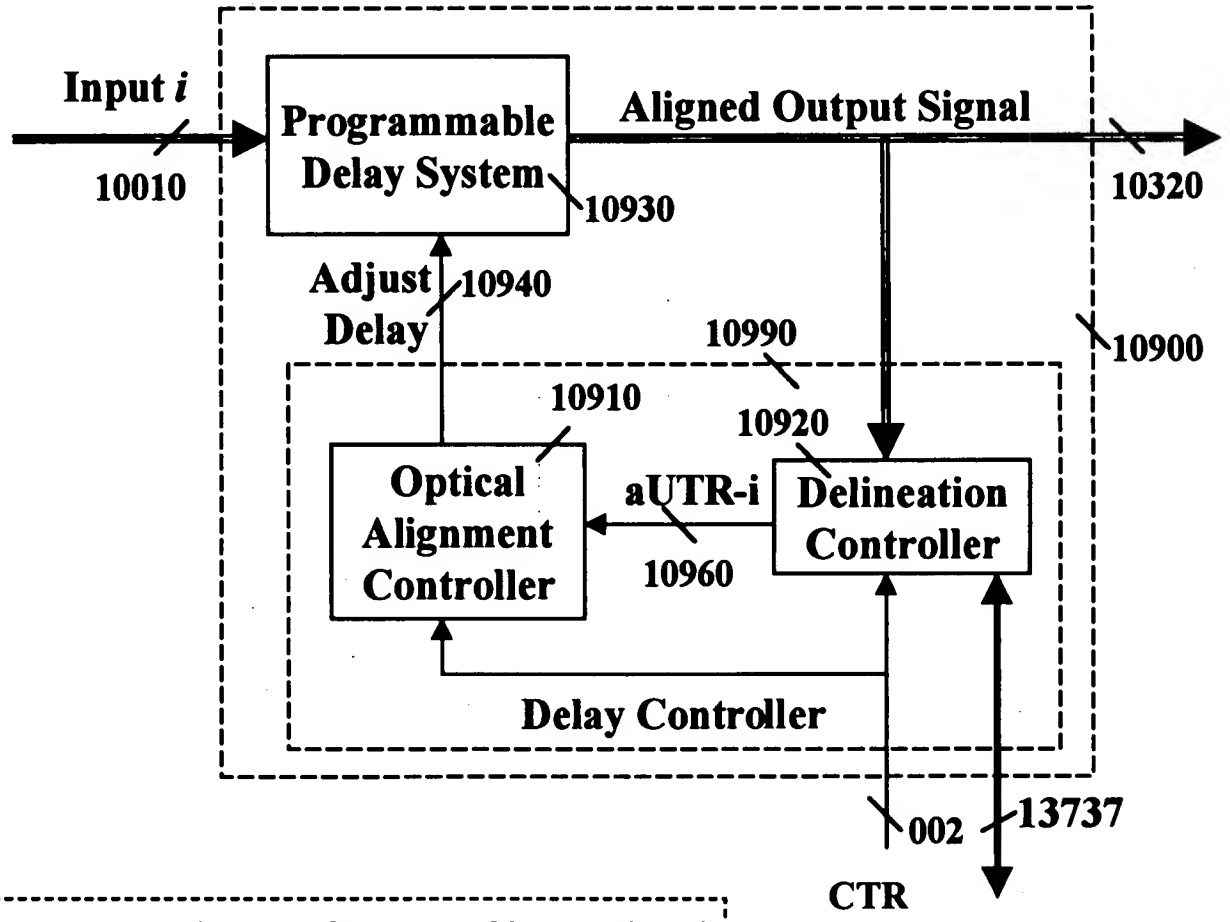


FIG. 30



UTR-i: Unique Time Reference of input link *i*
CTR: Common Time Reference

FIG. 31

POSM: Programmable Optical Switching Matrix

$d_{In1\text{-}Out1} = t_1 + 2 \cdot t_2 + 3 \cdot t_N$

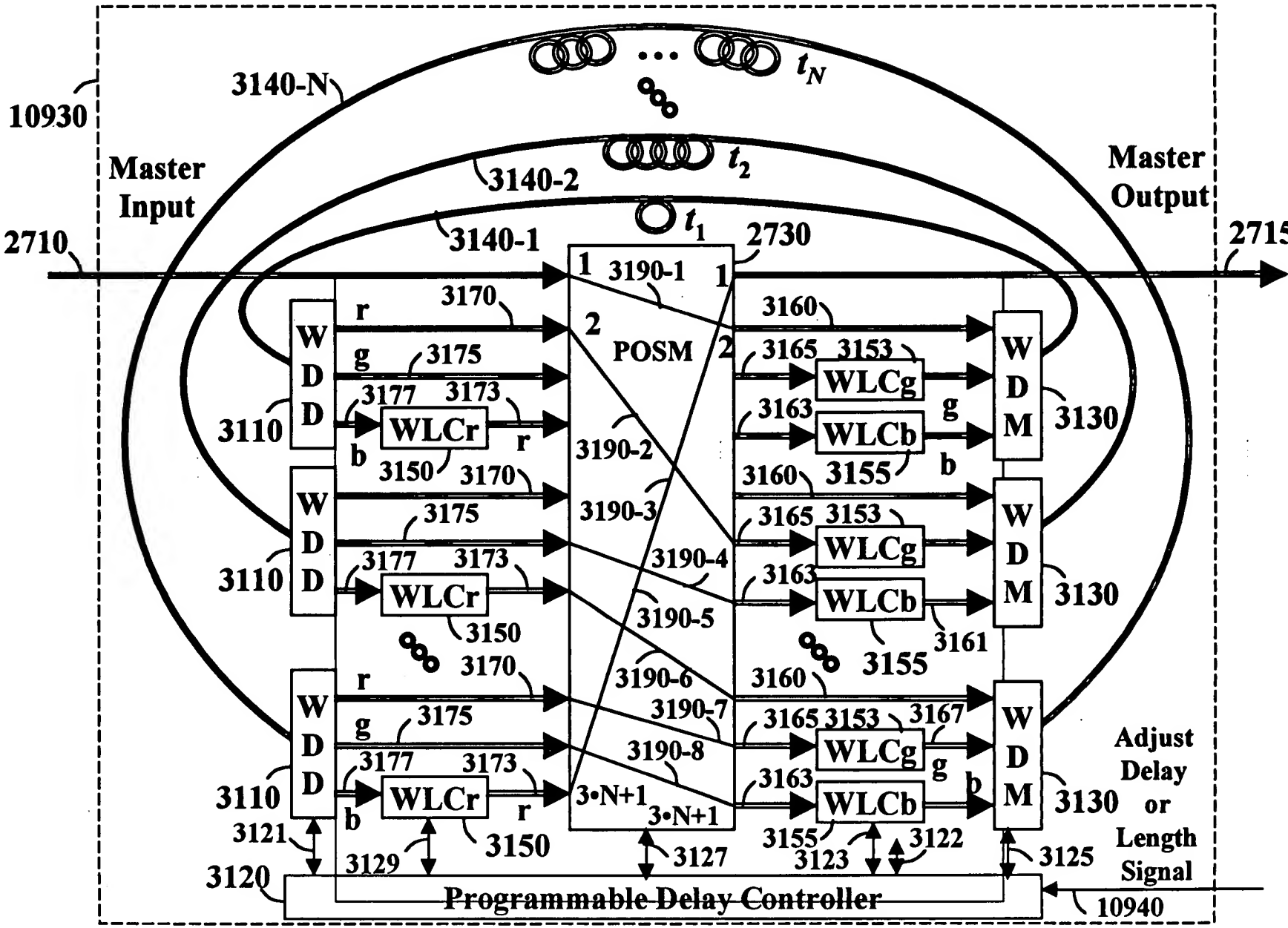


FIG. 32

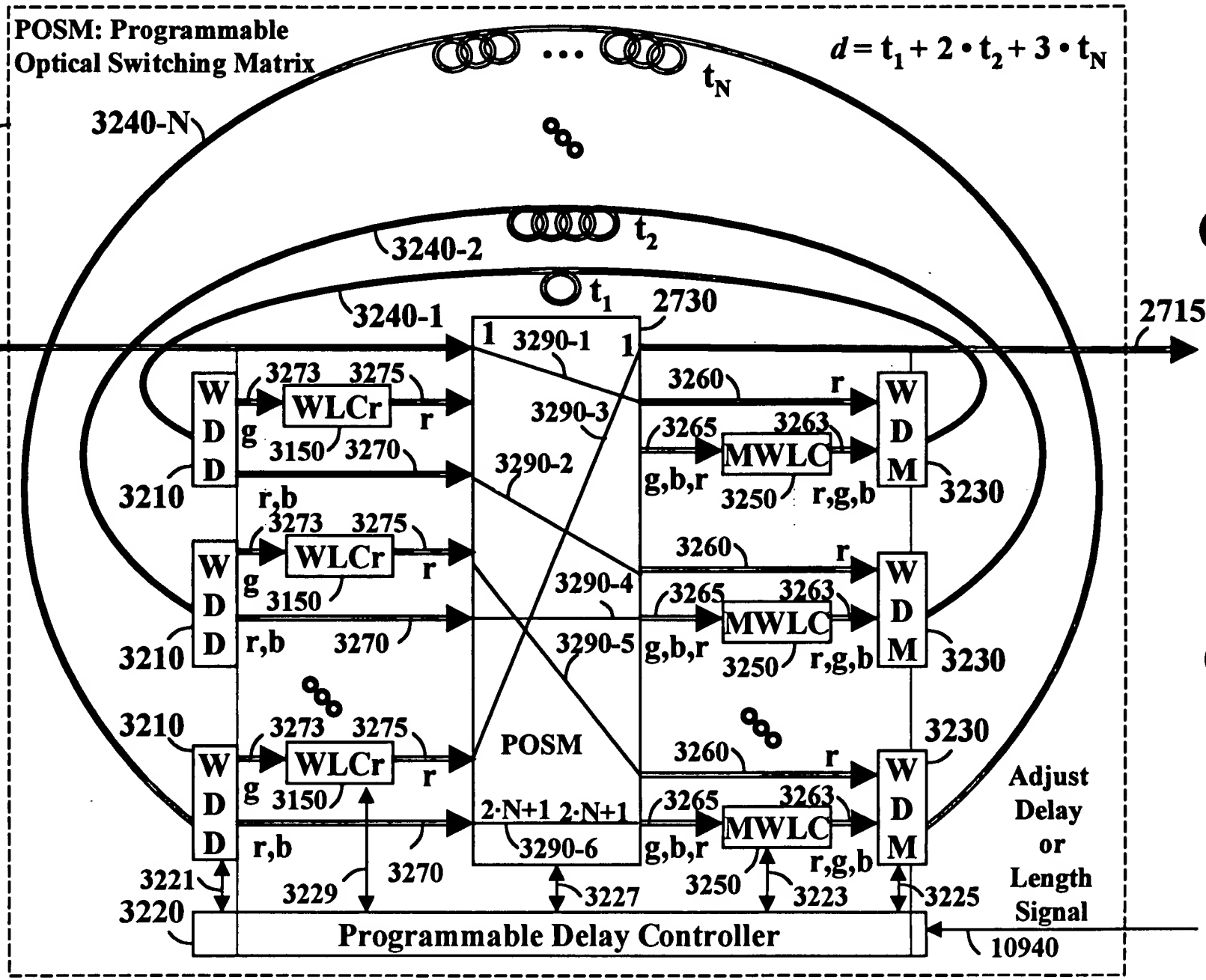

POSM: Programmable
Optical Switching Matrix
$d = t_1 + 2 \cdot t_2 + 3 \cdot t_N$
t_N
t_2
t_1
10930
3240-N
3240-2
3240-1
2710
2715
2730
1
3290-1
3290-2
3290-3
3290-4
3290-5
3290-6
2·N+1
2·N+1
POSM
3210
WDD
WLCr
3273
3275
3150
3270
g
r
r,b
3260
3265
3263
MWLC
3250
g,b,r
r,g,b
WDM
3230
3221
3220
3229
3227
3223
3225
Programmable Delay Controller
Adjust
Delay
or
Length
Signal
10940

FIG. 33

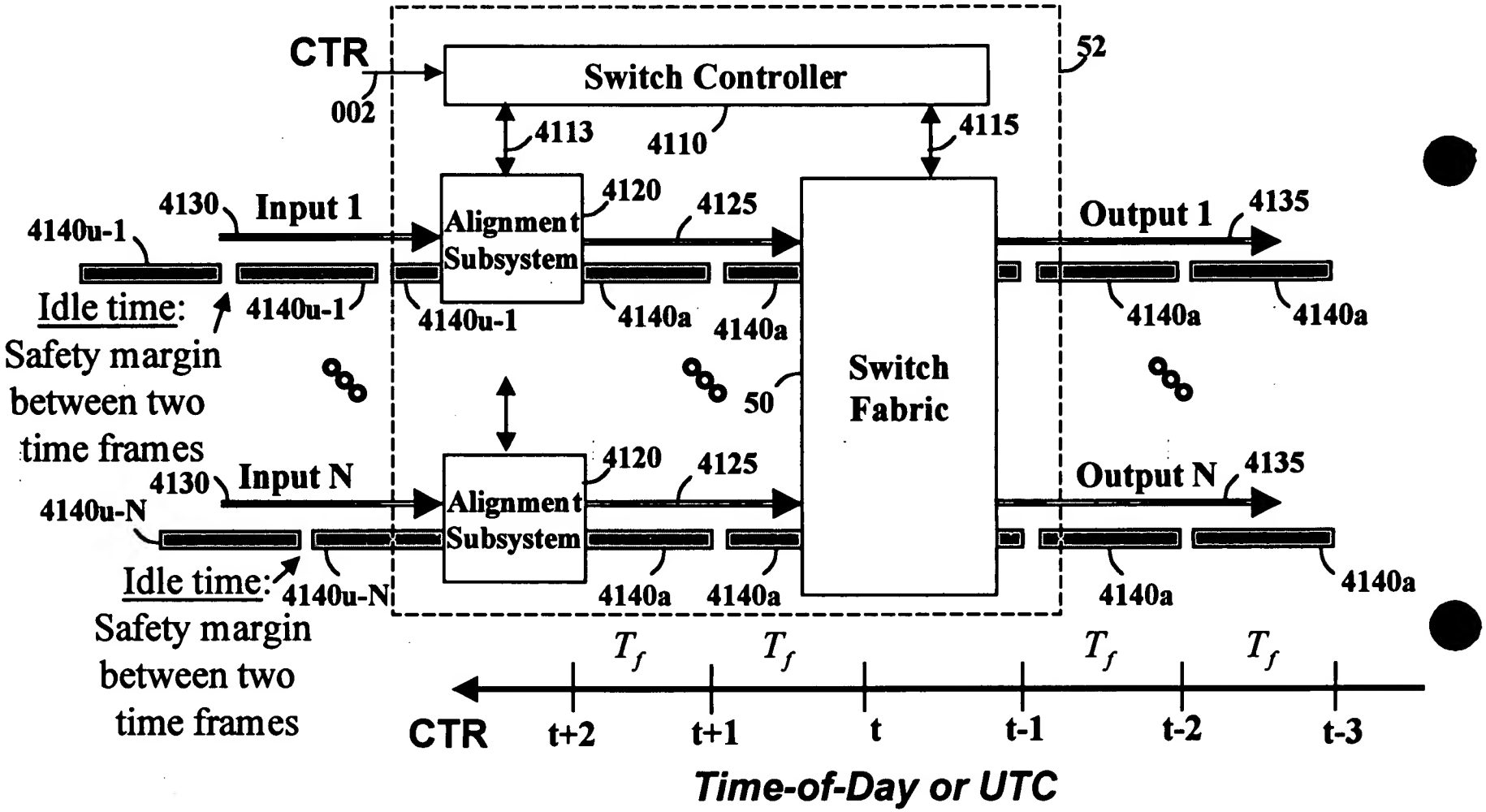


FIG. 34

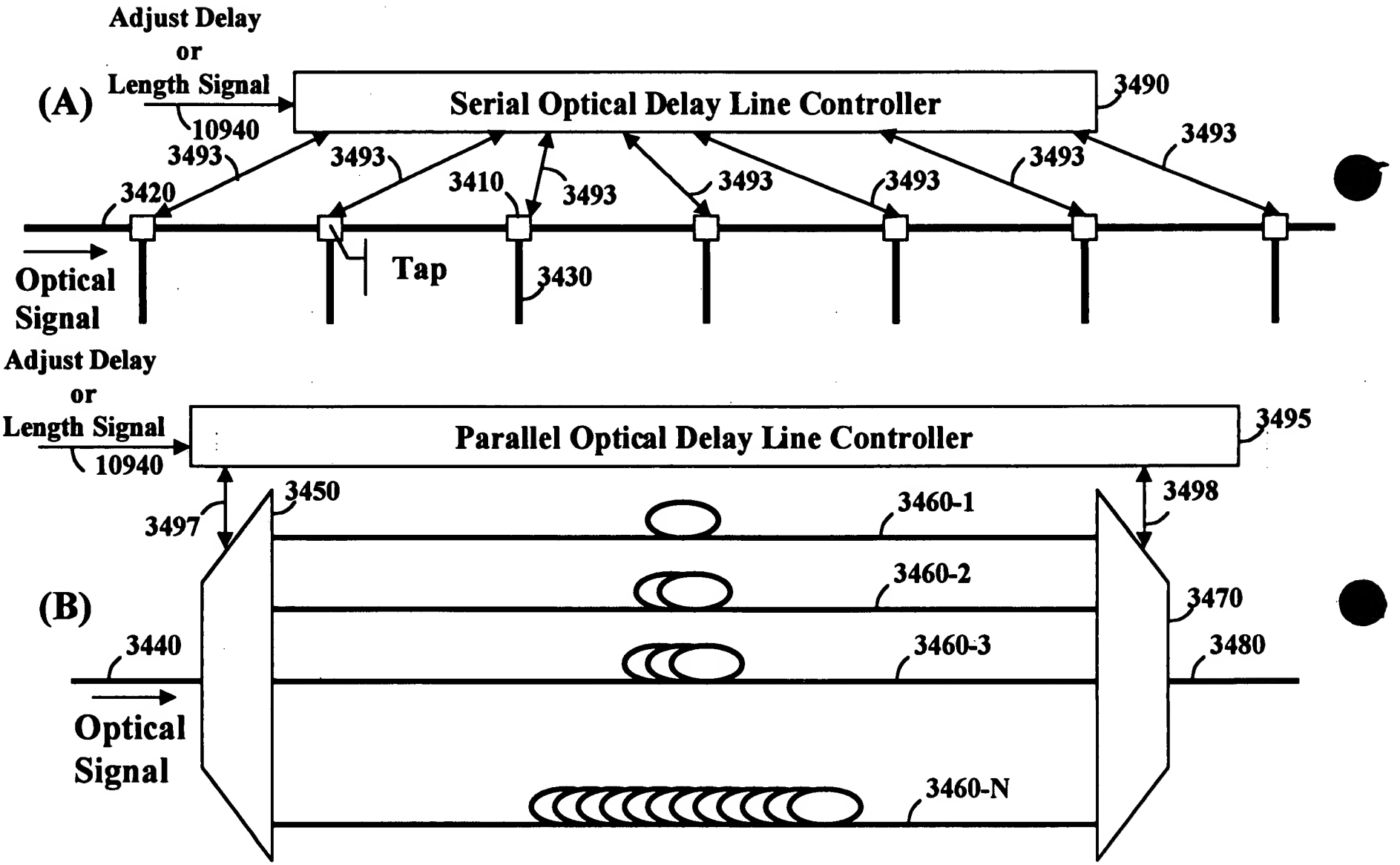


FIG. 35